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CHARACTERISTICS OF CHILDREN WITH EMOTIONAL PROBLEMS AND DEPRESSED MOOD

– AN EXAMINATION OF ASSOCIATIONS WITH
BEHAVIOUR, SLEEP, AND INHIBITORY CONTROL

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To my family

ABSTRACT

Emotional symptoms are symptoms of anxiety and depression that are included in the broad dimension of internalising symptoms encompassing feelings and behaviours such as fearfulness, worry, sadness, and withdrawal. Elevated levels of emotional symptoms are prevalent in children and often a precursor of adolescent and adulthood mental health disorders, such as major depression, one of the leading causes of disability in Finland and worldwide. The prevention of depression is a global challenge. Although major depression is a relatively rare condition in childhood, the more common emotional symptoms and subthreshold conditions of depression in childhood have been identified as possible targets for preventive action in the battle against depression.

Results of studies involving adolescent participants suggest that examining the precursors of depression at the symptom level could aid in recognising individuals at risk for escalation to more severe disorders. Depressed mood, an emotional symptom that is one of the core symptoms of depression, has been associated with a future risk of psychopathology and may also cause current impairment, increasing the importance of early detection. However, there has not been much research on depressed mood in children.

The present study examined the associations between emotional problems and depressed mood and three suggested risk factors for emerging, prolonging, and escalating emotional symptoms: inhibitory control, sleep problems, and co-occurring behaviour problems. The aim of the study was to provide data that would aid in the early recognition and prevention of emotional problems. Cross-sectional questionnaire data from the Strengths and Difficulties Questionnaire (SDQ) and the Quality of Life Questionnaire 17D were used in studies I–III, and the go/no-go task was used to assess children's inhibitory control in the longitudinal study IV.

The first study examined the prevalence of emotional problems and depressed mood in a population-based sample of 1,714 children aged 4–12. The associations of emotional problems and depressed mood with conduct problems and hyperactivity, as well as with child and family factors were also examined. In the population-based sample, 5.8% of the children had emotional problems and 16.0% had depressed mood. Both emotional problems and depressed mood were associated with sleep problems, illness or disability in children, and not living with both parents. Emotional problems and depressed mood were both significantly associated with conduct problems and hyperactivity. Of the emotional symptoms, depressed mood had the strongest association with both conduct problems and hyperactivity.

The second study examined the prevalence of emotional problems and depressed mood in a child psychiatric outpatient sample of 862 children aged

6–12 and the associations of emotional problems and depressed mood with conduct problems and hyperactivity. The impact of depressed mood on children's global functioning was also assessed. In the clinical sample, 13.1% of the children had emotional problems, and 59.4% had depressed mood. Emotional problems and depressed mood were significantly associated with conduct problems but not hyperactivity. Irrespective of diagnosis, depressed mood was consistently associated with poorer global functioning.

The third study examined the associations of child-reported sleep problems and emotional symptoms in a child psychiatric outpatient sample of 432 children aged 6–12. Child-reported sleep problems were the most common among children with depression or anxiety, and sleep problems were significantly associated with depressive disorders. Even among children with attention-deficit/hyperactivity disorder or oppositional defiant or conduct disorder, sleep problems were associated with emotional symptoms, suggesting that child-reported sleep problems are indicative of subthreshold emotional problems in these children.

The fourth study assessed the association between inhibitory control skills and internalising symptoms in a sample of 2,874 children aged 7–9 using a longitudinal design with a statistical model that distinguishes within-person variance from between-person variance between the constructs. Over the course of the study, the association between inhibitory control and internalising symptoms was explained at the between-person level. This finding supports the hypothesis that among children at this developmental stage, inhibitory control and emotional symptoms are associated as trait-like constructs. However, no cross-lagged associations suggesting a potential causal relationship were found.

The findings of these four studies suggest that depressed mood is associated with similar risk factors as emotional problems in general. When emotional problems are associated with conduct problems or hyperactivity, this association is mostly explained by depressed mood. The global functioning level was poorer among child psychiatric patients with depressed mood than among those with normal mood. The findings also suggest that when a child has a sleep problem, it is useful to evaluate the presence of emotional problems and depressed mood. The association between emotional problems and inhibitory control suggests they could have a shared background.

LYHENNELMÄ

Tunne-elämän oireet ovat masennukseen ja ahdistukseen liittyviä oireita, ja ne sisältyvät myös laajempaan internalisoivien oireiden määritelmään, joka kattaa sellaisia tunteita ja käyttäytymistä kuten pelokkuus, huolehtiminen, surullisuus tai vetäytyminen. Lisääntyneet tunne-elämän oireet ovat yleisiä lapsilla, ja ne edeltävät usein nuoruus- ja aikuisiän mielenterveyden häiriöitä, esimerkiksi vakavaa masennusta, joka on yksi yleisimmistä työkyvyttömyyden syistä niin Suomessa kuin kansainvälisesti. Masennuksen ennaltaehkäisy on maailmanlaajuinen haaste. Vakava masennus on lapsuudessa melko harvinainen, mutta muut tunne-elämän oireet ja diagnoosikynnyksen alle jäävät masennusoireet yleisempiä, ja onkin esitetty, että vakavaa masennusta voisi ehkäistä niihin kohdistuvien toimenpitein.

Nuoruusikäisillä tehdyissä tutkimuksissa on saatu alustavia viitteitä siitä, että yksittäisten masennusoireiden tarkempi tutkiminen voisi edistää niiden nuorten tunnistamista, joilla on riski sairastua vakavampiin häiriöihin. Masentunut mieliala on tunne-elämän oire ja myös yksi masennuksen ydinoireista. Masentunut mieliala voi lisätä myöhemmän häiriön riskiä, ja voi jo itsessään aiheuttaa toimintakyvyn laskua, mistä syystä sen varhainen tunnistaminen on tärkeitä. Toistaiseksi tutkimustietoa lasten masentuneesta mielialasta ei juurikaan ole.

Tässä tutkimuksessa selvitettiin tunne-elämän oireiden ja masentuneen mielialan yhteyksiä lapsen inhibitiokykyyn, univaikeuksiin sekä rinnakkain esiintyviin käyttäytymisen oireisiin. Nämä kolme riskitekijää on aikaisemmin yhdistetty tunne-elämän oireiden ilmenemiseen, pitkittymiseen sekä vaikeutumiseen. Tutkimuksen tavoitteena oli tuottaa tietoa, jonka avulla voidaan edistää tunne-elämän oireiden varhaista tunnistamista sekä ennaltaehkäisyä. Osatutkimukset I–III ovat poikkileikkaustutkimuksia, joissa hyödynnettiin Vahvuudet ja vaikeudet -kyselyllä (SDQ) sekä lasten elämänlaatumittari 17D:llä kerättyä tietoa. Pitkittäisasetelmassa toteutetussa osatutkimuksessa IV käytettiin lisäksi go/no-go-tehtävää lasten inhibitiokyvyn mittarina.

Ensimmäisessä osatutkimuksessa tutkittiin tunne-elämän ongelmien ja masentuneen mielialan yhteyttä 4–12-vuotiaiden lasten väestöaineistossa (n = 1714) sekä tarkasteltiin tunne-elämän ongelmien ja masentuneen mielialan yhteyttä käytösongelmiin ja ylivilkkausoireisiin sekä lapseen ja perheeseen liittyviin taustatekijöihin. Väestöaineistossa 5,8 %:lla lapsista esiintyi tunne-elämän ongelmia ja 16,0 %:lla masentunutta mielialaa. Sekä tunne-elämän ongelmat että masentunut mieliala olivat yhteydessä lapsen univaikeuksiin, lapsen sairauteen tai vammaan sekä siihen, että molemmat vanhemmat eivät asuneet yhdessä lapsen kanssa. Sekä tunne-elämän oireet että masentunut mieliala olivat yhteydessä käytösongelmiin ja ylivilkkausoireisiin. Yksit-

täisistä tunne-elämän oireista masentunut mieliala oli vahvimmin yhteydessä sekä käytösongelmiin että ylivilkkausoireisiin.

Toisessa osatutkimuksessa tutkittiin tunne-elämän ongelmien ja masentuneen mielialan yleisyyttä 6–12-vuotiaiden lastenpsykiatristen avohoitopotilaiden aineistossa (n = 862) sekä tunne-elämän ongelmien ja masentuneen mielialan yhteyttä käytösongelmiin ja ylivilkkausoireisiin. Lisäksi tarkasteltiin masentuneen mielialan yhteyttä toimintakykyyn. Potilasaineistossa 13,1 %:lla lapsista oli tunne-elämän ongelmia ja 59,4 %:lla masentunutta mielialaa. Sekä tunne-elämän ongelmat että masentunut mieliala olivat yhteydessä käytösongelmiin, mutta eivät ylivilkkausoireisiin. Masentunut mieliala oli yhteydessä alentuneeseen toimintakykyyn riippumatta diagnoosista.

Kolmannessa osatutkimuksessa tarkasteltiin lapsen raportoitujen univaikeuksien yhteyttä tunne-elämän oireisiin 6–12-vuotiaiden lastenpsykiatristen avohoitopotilaiden aineistossa (n = 432). Univaikeudet olivat yleisimpiä lapsilla, joilla oli jokin mieliala- tai ahdistushäiriö. Univaikeudet olivat erityisesti yhteydessä mielialahäiriöihin. Aktiivisuuden ja tarkkaavuuden häiriön sekä uhmakkuus- tai käytöshäiriön yhteydessä univaikeudet olivat yhteydessä tunne-elämän oireiden määrään. Lapsen ilmoittama univaikeus voi näissä potilasryhmissä viitata diagnoosikynnyksen alle jääviin tunne-elämän oireisiin.

Neljännessä osatutkimuksessa analysoitiin inhibitiokyvyn ja tunne-elämän oireiden yhteyttä pitkittäisasetelmassa 7–9-vuotiaiden lasten aineistossa (n = 2874) käyttäen tilastollista mallinnusta. Menetelmällä voidaan erottaa yhteydet, jotka johtuvat eroista yksilöiden väleillä yhteyksistä, jotka johtuvat yksilötasolla tapahtuvista tutkittavien ilmiöiden muutoksista. Tutkimuksen seuranta-aikana lasten inhibitiokyky ja tunne-elämän oireet olivat yhteydessä toisiinsa yksilöiden välisellä tasolla. Tämä tukee hypoteesia, että tässä kehitysvaiheessa inhibitiokyky ja tunne-elämän oireet ovat yhteydessä toisiinsa kuten piirteet, joilla on kehityksellistä jatkuvuutta. Inhibitiokyvyn ja tunne-elämän oireiden välillä ei havaittu ristiviiveyhteyksiä, jotka voisivat viitata kausaalisuhteisiin.

Kokonaisuudessaan tutkimustuloksemme viittaavat siihen, että masentunut mieliala on yhteydessä samankaltaisiin riskitekijöihin kuin tunne-elämän oireet yleensä. Tunne-elämän oireiden ja käyttäytymisen oireiden yhteys vaikuttaa selittyvän pääasiassa masentuneen mielialan yhteydellä käyttäytymisen oireisiin. Masentunut mieliala on yhteydessä myös alentuneeseen toimintakykyyn lastenpsykiatrisilla potilailla. Tuloksemme viittaavat myös siihen, että mikäli lapsella on univaikeuksia, on syytä arvioida, onko lapsella tunne-elämän oireita tai masentunut mieliala. Tunne-elämän oireilla ja alentuneella inhibitiokyvyllä voi olla yhteinen tausta.

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LIST OF ORIGINAL PUBLICATIONS

This thesis is based on the following publications, referred to in the text by their Roman numerals:

- I Maasalo, K., Fontell, T., Wessman, J. & Aronen, E. T.
Sleep and behavioural problems associate with low mood in Finnish children aged 4–12 years: an epidemiological study. *Child and Adolescent Psychiatry and Mental Health* 10, 37 (2016)
(doi:10.1186/s13034-016-0125-4)
- II Maasalo, K., Wessman, J. & Aronen, E. T.
Low mood in a sample of 5–12-year-old child psychiatric patients; a cross-sectional study. *Child and Adolescent Psychiatry and Mental Health* 11, 50 (2017).
(doi:10.1186/s13034-017-0183-2)
- III Maasalo, K., Karppinen, J., Wessman, J., Huhdanpää H. & Aronen, E. T.
Child-reported sleep complaints and psychiatric symptoms in 6–12-year-old child psychiatric outpatients. Submitted to *Child: Care, Health and Development*.
- IV Maasalo, K., Lindblom, J., Kiviruusu, O., Santalahti P. & Aronen, E. T.
Longitudinal associations between inhibitory control and externalizing and internalizing symptoms in school-aged children. *Development and Psychopathology* (2020).
(doi:10.1017/S0954579420000176)

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ABBREVIATIONS

ADHD	Attention-deficit/hyperactivity disorder
BDI	Beck's Depression Inventory
BEAA	Body Esteem Scale for Adolescents and Adults
CBCL	Child Behaviour Checklist
CD	Conduct disorder
CDI	Children's Depression Index
CDRS-R	Children's Depression Rating Scale – Revised
CES-D	The Center for Epidemiologic Studies of Depression
CGAS	Children's Global Assessment Scale
CI	Confidence interval
DAWBA	Development and Well-Being Assessment
DMDD	Disruptive mood dysregulation disorder
DSM-5	<i>Diagnostic and Statistical Manual of Mental Disorders</i> , 5th edition
EF	Executive function
ETI	Emotional Tone Index
GAD	Generalised anxiety disorder
GAF	Global Assessment of Functioning
IC	Inhibitory control
ICD-10	<i>International Classification of Diseases</i> , 10th edition
MDD	Major depressive disorder
MFQ	Mood and Feelings Questionnaire
ODD	Oppositional defiant disorder
OR	Odds ratio
PSG	Polysomnography
PTSD	Post-traumatic stress disorder
RI-CLPM	Random intercepts cross-lagged panel model
SD	Subthreshold depression
SDQ	Strengths and Difficulties Questionnaire
SES	Socioeconomic status
SMFQ	Short Mood and Feelings Questionnaire
SPI	Standardised psychiatric interview
YSR	Youth Self Report

1 INTRODUCTION

Major depressive disorder, hereafter referred to as depression, is a mental disorder characterised by depressed (i.e., lowered) mood, the loss of interest or pleasure, and decreased energy or increased fatigue (1,2). Depression affects 4.4% of the population at any given time and up to 20% of children by the end of adolescence (3,4). Depression is the leading cause of disability worldwide (3). Thus, the prevention of depression should be a public health priority.

Approximately 50% of young Finnish adults disabled due to depression report that their psychiatric symptoms first occurred in childhood (5). Many researchers have emphasised the importance of recognising depressive symptoms early in the course of depression to prevent more severe conditions (6–8). Research suggests that subthreshold depressive symptoms (i.e., symptoms that do not meet the criteria for depression) not only predict later, more severe depression but also cause current impairment (9). Among adolescents and adults, depressed mood has also been shown to predict later depression (10,11), but few studies have been conducted on the significance of depressed mood in children.

Children with emotional problems often exhibit irritability or symptoms of oppositional defiant disorder, which also are associated with future depression (12,13). A new diagnosis, disruptive mood dysregulation disorder (DMDD), was included in the chapter on depressive disorders in the latest edition of the Diagnostic And Statistical Manual Of Mental Disorders, currently in its fifth edition (DSM-5) (2). DMDD is characterised by persistent irritability and severe, frequent temper outbursts. This new diagnosis warrants further research on the relationship between mood and behaviour in different populations.

Sleep problems are strongly associated with emotional problems and disorders, although the findings are mixed, and robust evidence of the association in children is still lacking (14). Among studies involving clinical child populations, children's self-reported sleep data are relatively scarce. Since children are considered valuable informants of emotional problems (15–18), and emotional problems are closely associated with subjective sleep problems (19,20), the paucity can be considered a gap in the research.

Inhibitory control (IC) is considered crucial in the development of self-regulation (21), and deficits in IC are associated with emotional problems (22–24). There are several possible mechanisms for the association. IC deficits have been suggested to predispose to emotional problems, for example via an increased tendency to ruminate (24). Then, it has been suggested that IC deficits may accompany rumination that emerges with emotional symptoms or disorders (25). Depressive episodes have also been suggested to cause perma-

nent impairments in IC (26). Finally, as IC is associated with a range of psychiatric symptoms and disorders, it has been proposed that IC deficits could be a biological marker of a portion of the genetic risk for psychopathology (27). The findings thus far are mixed, and longitudinal studies examining the possible patterns of causality are especially lacking (28).

In this study, we examined the prevalence of emotional problems and depressed mood in a community population of children and in a sample of patients from the Helsinki University Hospital child psychiatric outpatient unit. Depressed mood was chosen under examination because it has been found to be the most sensitive of the core symptoms of depression in detecting both subthreshold and clinical depression (29,30) and it is analogously included in central screening instruments of childhood problem behaviour (31,32). Also, it has been previously shown with the Child Behavior Checklist (CBCL), that the single item tapping depressed mood is the one single item that best discriminates clinical from non-clinical children (32). We also examined the associations between these symptoms and with behaviour problems, sleep problems, and inhibitory control skills using novel approaches.

Our goal was to provide new information on the prevalence of and factors associated with emotional problems and depressed mood in population-based and clinical samples. We aimed to enhance the recognition of symptoms and related factors that may be indicative of a need for further assessment or intervention. This outcome is important in terms of preventing depression, as well as of other mental health problems and functional impairment.

2 REVIEW OF THE LITERATURE

2.1 EMOTIONAL SYMPTOMS AND DEPRESSED MOOD IN CHILDREN

2.1.1 Overview

Emotional symptoms

Emotional symptoms are feelings, thoughts or behaviours related to anxiety and depression. Symptoms of depression and anxiety are closely associated and thus often considered on a single dimension (33). In the present study emotional symptoms are defined through the Strengths and Difficulties Questionnaire (SDQ) (31), an instrument for screening problem and prosocial behaviour in children, where the emotional symptoms include sadness or tearfulness, worrying, fearfulness, nervousness in new situations, and somatic complaints. Emotional symptoms can be considered a subdimension included in the broader dimension of internalising symptoms that encompasses also other inward-directed feelings and behaviours such as withdrawal and loneliness (31,32).

When defining psychiatric disorders, these emotional symptoms are considered categorically. Symptoms constitute a disorder (e.g., major depressive disorder or generalised anxiety disorder) when they both quantitatively and qualitatively meet the diagnostic criteria delineated in the current editions of the *Diagnostic And Statistical Manual Of Mental Disorders* (2) or the *International Classification of Diseases* (1). As symptoms of depression and anxiety often coexist at the subthreshold level, observations of the presence and severity of emotional symptoms are often based on symptom levels on the single emotional dimension, especially in population-based samples (33–37). Elevated or abnormal levels of emotional symptoms are often and also in this study referred to as emotional problems. It has been recommended that both dimensional and categorical approaches should be taken into account in clinical research and clinical practice (38,39).

Depressed mood

Depressed mood, often described as ‘low’, ‘dysphoric’, ‘sad’, or ‘blue’, is one of the emotional symptoms as well as one of the core symptoms of depression. Mood, in general, is a relatively persistent state of how a person is feeling (40). The diagnostic criteria for major depression (MDD) require at least 1–2 core symptoms, depressed mood (or irritability), anhedonia (i.e., loss of interest or diminished pleasure) or decreased energy or increased fatigue, to be present, as well as additional depressive symptoms so that at least 4–5 symptoms

must be present for at least 2 weeks and cause marked impairment or distress (1,2). The additional symptoms marked changes in appetite, slowing down of thoughts and movements, excessive feelings of guilt and worthlessness, difficulty concentrating and making decisions, recurrent thoughts of death or suicidal ideation, and sleep disturbances. Acknowledging the dimensional view of depression, the revised fourth edition of the DSM (DSM-IV-TR) included a classification called minor depressive disorder. To meet the criteria for minor depression, 2–4 depressive symptoms (i.e., depressed mood or anhedonia accompanied by 1–3 additional symptoms), were required to be present.

Some findings among adolescents and adults suggest that the presence of either of the core symptoms (depressed mood or anhedonia) is predictive of subsequent depression (11,41,42). It has been suggested that a symptom-level approach to depression in research could help in identifying individuals at risk for future depression among those with subthreshold symptoms (11). Relatively few studies have extended the study of the continuum to the examination of individual symptoms (see *Table 1*).

2.1.2 Prevalence

Emotional symptoms

Most children experience low or moderate levels of emotional symptoms during childhood; however, a high-risk group with high levels of emotional symptoms in childhood can be identified (43–45). In childhood, although emotional problems may affect boys slightly more than girls (46,47), significant gender differences have often not been found in prior research (48,49). During adolescence, gender differences emerge as there is a marked rise in emotional symptoms and disorders among girls (4,6,44).

It is estimated that, globally, 6.5% of children meet the criteria for an anxiety disorder, and 2.6% meet the criteria for a depressive disorder (50). In a sample representative of a total annual Finnish birth cohort born in 1981, the estimated prevalence (using DSM-III criteria) among 8–9-year-old children was 5.2% for general anxiety, 6.2% for any depressive disorder, and 2.4% for specific fears (51). In 2017, approximately 2% of 0–12-year-old Finnish children were treated for depression by specialist psychiatric healthcare providers (52). Among children in primary school classes 2–4 in Bergen, Norway, the weighted prevalence of emotional disorders (i.e., any depressive or anxiety disorder) was 3.2% and 3.4%, according to DSM-IV and ICD-10 criteria, respectively (53). A Danish cohort study examined the cumulative incidence of emotional disorders in the population based on national register data (47) and found the cumulative incidence of any emotional disorder to be 0.52% among boys and 0.31% among girls prior to their 11th birthday, and 2.33% and 3.77% among boys and girls, respectively, prior to their 19th birthday.

In a German community sample of 3–5-year-old children, 12% of the children had at least somewhat elevated (borderline/abnormal) emotional symptom levels (54), while in a 5–7-year-old Danish sample, this was true for 13.7% of the children (36). Among the Danish children, it was estimated that 1.5% of the sample had a probable emotional disorder when considering teacher evaluations of emotional symptoms and the level of impairment.

In a large, nationwide German sample of 3–17-year-old youth, 16.3% of the sample had elevated (i.e., borderline/abnormal) emotional symptoms (55). When examining the levels of self-reported depression and anxiety symptoms separately in the older children and adolescents in the sample, it was found that 10.7% of the 7–10-year-old children and 11.1% of the 11–17-year-olds reported depression symptoms above a clinical cut-off, while regarding anxiety symptoms, the same was true for 14.3% of the younger children and 9.9% of the older children (56). The proportion of children with elevated depression or anxiety symptoms and impairment was 4–6%.

Sellers et al. (49) examined the rates of mental health problems in 7-year-old children in three nationally representative cohorts from 1999 to 2008 in the United Kingdom. As a measure of mental health problems, they used parent and teacher ratings of the Strength and Difficulties Questionnaire (SDQ) (31). Parent ratings of emotional problems decreased significantly between 1999 and 2008 for both girls and boys, but there were no differences in teacher ratings. According to the parent ratings, approximately 11% scored in the abnormal range in 1999 and 8% in 2008.

In the Netherlands, Bot et al. (48) examined quality of life using KID-SCREEN-10 and the prevalence of psychosocial problems using the SDQ in a sample of 8–12-year-old children. All questionnaires were completed by parents. In the study, 7.5% of the girls and 8.1% of the boys scored in the abnormal range on the emotional problems score according to cut-offs determined by a previous study involving a Dutch sample.

Depressed mood

While depressive symptoms, in general, have been studied extensively, only a small fraction of the studies have examined depressed mood in children or adolescents. One of them was a Danish study of 8–10-year-old children conducted to investigate the differences between subthreshold depression and major depression in a population-based sample (29). Based on the results of the Development and Well-Being Assessment (DAWBA), an internet-based diagnostic tool, the prevalence of depressed mood was 16.4% among children in the non-depressed control group. In another study of a sample of 14–18-year-old adolescents in the United States (US), the point prevalence of depressed mood was 9.5% in the total sample and 7.5% in the adolescents who had never been depressed, based on a diagnostic interview (11).

A Finnish birth cohort study examined parent-reported psychiatric symptoms of 8–9-year-old children with and without self-reported depressive symptoms (57). Approximately 9.3% of the cohort were reported as being miserable or tearful by their parents (statement applying to some extent/certainly).

Some studies have reported prevalence rates of individual symptoms based on endorsement rates of items on questionnaires designed for screening or measuring depressive symptoms (58–64). One of these questionnaires is the Mood and Feelings Questionnaire (MFQ) (65), which includes the statements ‘I feel miserable or unhappy’ and ‘I cry a lot’. The respondent is instructed to choose how *often*, during the last two weeks, the statement applies. The options are ‘not true’, ‘sometimes true’, and ‘true’. According to parent reports in a sample of 9–17-year-old youth, 4.1% of the boys and 6.9% of the girls felt unhappy most of the time, and 0.9% of the boys and 3.6% of the girls cried a lot most of the time (58). According to self-ratings, the rates were 2.4% and 8.8% for feeling unhappy and 1.1% and 7.7% for crying among boys and girls, respectively. Among a sample of 13–14-year-old adolescents, 38.3% chose the ‘sometimes true’ option and 3.1% the ‘true’ option for the ‘unhappy’ item and 14.5% and 5.4% for the crying-item. In a sample of 10–15-year-old Australian youth, as much as 73.6% endorsed either the ‘sometimes true’ or ‘true’ option (59).

The SDQ (31), described in greater detail in the Methods section, includes the item, ‘often unhappy, downhearted, or tearful’, and the respondent is instructed to choose how *well* the statement applies during the last 6 months by selecting ‘not true’, ‘somewhat true’, or ‘certainly true’. According to parent ratings among a Swedish sample of 6–10-year-old children, the statement was somewhat true in 8.2% of the children and certainly true in 0.8% of the children (60). According to self-reports in Nordic studies of 10–17-year-old youth, the ratings for ‘somewhat true’ ranged from 9% to 29%, and the ratings for ‘certainly true’ from 2% to 10% (61–64). The lowest rates were found among male respondents and the highest among female respondents. Among a sample of Finnish 13–17-year-old adolescents, the ‘somewhat true’ and ‘certainly true’ rates were 26.3% and 5.3%, respectively (62).

A Danish study that examined socioeconomic differences in emotional symptoms among 11–15-year-old adolescents in Nordic countries reported that 2.3–5.7% of adolescents felt ‘low’ according to results of the Health Behaviour in School-aged Children Survey (66). The lowest rate (2.3%) was found among Finnish adolescents.

When interpreting the above findings it is important to note the effect of the different raters on the prevalences. For example, parents may report fewer emotional symptoms than their offspring (67,68) or than recognized by a clinician (69) as they may not be aware of them. On the other hand, parents

own depression may cause an opposite bias in the rates (70,71). Then, children themselves may not be very reliable in evaluating past symptoms, and their reports may also include transient feelings of low mood in addition to persistent depressed mood (72).

2.1.3 Emotional problems and depressed mood as predictors in cross-sectional and longitudinal settings

In general, having emotional symptoms is associated with a lower quality of life (48,73). In a large population-based German study that examined the impairment associated with mental health problems among youth, self-reported emotional problems were the strongest predictors of perceived difficulties, impact, and burden (74). Emotional symptoms are stable and predict subsequent emotional problems and disorders (75–77), and thus, have been proposed to be a target for preventive actions to avoid the development of clinical disorders (78).

Although subthreshold depression is not directly within the scope of this study, it is closely related to the more inclusive construct of emotional symptoms, as well as depressed mood. The rationale for examining depressed mood is primarily based on the study of subthreshold depression, thus warranting review. Several studies support the dimensional view of depression based on the similarities regarding risk factors, impairment, and future outcomes associated with depressive symptoms below and above the diagnostic threshold for major depressive disorder (MDD) (8,9,79–83).

First, subthreshold depression is associated with current impairment (79). Pickles and colleagues (79) found a linear association with impairment severity and the number of depressive symptoms and that the diagnostic threshold does not have a significant impact on impairment scores. Of the children with 2–4 symptoms of depression, approximately 50% were impaired by the symptoms. Interestingly, they also found that having depressive symptoms but not the level of impairment at baseline predicted having depressive symptoms, being diagnosed with depression, and the level of impairment at follow-up, suggesting that in terms of prevention, symptoms without impairment should also be considered meaningful.

Second, subthreshold depression in childhood and adolescence are associated with later MDD, as well as with other mental health problems (8,82,84,85). Among a sample of adolescents, the risk of future MDD associated with subthreshold depression was similar to the risk associated with having a parent with depression (82). Furthermore, other adverse outcomes, such as poorer global functioning (8,82), alcohol and substance use (86–88), adulthood obesity and increased blood pressure (89), and reduced physical activity (90), are also associated with childhood and adolescence subthreshold depression. Studies that examined future outcomes of depressed mood or

Table 1. Longitudinal studies examining prospective associations of depressed mood or subthreshold depression in childhood or adolescence and future outcomes

Author	Sample	Age (T_0)	Time to / age at last follow-up	Definition of depressed mood / SD	Future associations of depressed mood or SD
Srinivas (2018) (88)	n = 14,436	12–21	15 years	'Sad', 'depressed', 'crying a lot'	Feeling sad is associated with adulthood obesity and increased blood pressure.
Uchida (2018) (81)	n = 402, referred sample	6–17	10 years	T-score ≥ 55 and < 70 in CBCL anxiety/ depression scale	SD is associated with MD, bipolar disorder, anxiety disorders and poorer GAF.
Dahlqvist (2016) (93)	n = 2,342	14–16	2 years	Negative affect (NA) dimension of CES-D	NA predicts sexual harassment victimisation in the form of name-calling in boys.
Kouros (2016) (92)	n = 240	11–12	6 years	CDRS-R	Depressed mood does not predict future MD.
McLeod (2016) (85)	n = 995	14–16	At age 30/35	No symptoms SD ≥ 1 symptoms MD (DSM-III)	SD increases the risk for MD, anxiety disorder, substance abuse/dependence, any mental health problem, and partner violence victimisation.
Allen (2014) (94)	n = 179	14–16	At age 20–23	CDI < 19	SD is associated with future loneliness and a poorer maternal relationship.
Bennik (2014) (90)	n = 2,230	11	At age 19	'I am sad, unhappy or depressed' (YSR)	Depressed mood at t–1 significantly predicts anhedonia at t.
Roberts (2014) (95)	n = 3,134	11–17	1 year	Depressed/irritable mood or anhedonia in the past 12 months	Depressed/irritable mood or anhedonia does not predict later sleep deprivation.
Roberts (2013) (96)	n = 3,134	11–17	1 year	Depressed/irritable mood or anhedonia in the past 12 months	Depressed/irritable mood or anhedonia predicts later insomnia symptoms but not insomnia with impairment or isolated insomnia without a mood/anxiety/substance use disorder.
Patten (2012) (83)	n = 15,254	12–	14 years	SD: Depressed mood/anhedonia not meeting MD criteria	SD, even without distress or < 4 weeks in duration, increases the risk of future MD. The presence of either distress or a long duration further increases the risk.
Jonsson (2011) (97)	n = 382	16–17	15 years	SD: BDI ≥ 16 or CES-DC ≥ 30 + BDI ≥ 11 , but not meeting DD criteria	SD is associated with future chronic depression and PTSD but not most of the examined disorders.

Table 1 continues

Table 1 continued

Author	Sample	Age (T_0)	Time to / age at last follow-up	Definition of depressed mood / SD	Future associations of depressed mood or SD
Lundh (2011) (98)	n = 879	13–14	1 year	From depression-related items of SDQ, ETI and BEAA	Mild/moderate depression, but not symptoms of sadness/loneliness without any other depressive symptoms, predicts self-harm.
McKenzie (2011) (58)	n = 5,769	10–15	1 year	Single SMFQ items, 'miserable or unhappy'	In logistic regression containing all SMFQ items, 'miserable or unhappy' is associated with later high depressive symptoms but is not among the symptoms with the most predictive value.
Tucker (2011) (99)	n = 4,329	14	At age 16	Feeling 'sad, blue, depressed or down in the dumps'	Depressed mood predicts running away from home.
Jerstad (2010) (89)	n = 496	13	6 years	SD: 4 depression symptoms + 1 subthreshold depression symptom	Depressive symptoms and minor depression predict reduced future physical activity.
Fichter (2009) (86)	n = 269	9–22	18 years	Individual psychiatric symptoms (SPI) incl. depressed mood	Subjective depressed mood is associated with later substance use disorder but not depression, anxiety, or other mental disorders.
Johnson (2009) (100)	n = 755	M = 13.7	At mean age 22/33	DSM-III criteria for minor depression	Minor depression increases the risk of future MD, GAD, disruptive disorders, and personality disorders.
Klein (2009) (84)	n = 225, with life-time SD	M = 16.6	At age 30	SD: depressed mood/ anhedonia lasting ≥ 1 wk + ≥ 2 other depression symptoms	Estimated risk for escalation to depressive disorder was 67%. Symptom severity, medical conditions, history of suicidal ideation, history of anxiety disorder, and familial risk for depression are uniquely associated with escalation risk.
Rohde (2009) (101)	n = 496	12–15	7 years	SD: Number of symptoms meeting MD criteria but ≥ 1 symptom of subthreshold severity	SD increases the risk for future MD.
Shankman (2009) (102)	n = 1,505	14–20	At age 30	SD: depressed mood/ anhedonia lasting ≥ 1 wk + ≥ 2 other	SD increases the risk for future MD even when adjusting for comorbid subthreshold conditions.
Crum (2008) (87)	n = 1,526	9–13	4 years	'Bad mood', 'sad', 'crabby/cranky' 'felt like crying' (almost) daily ≥ 2 weeks	Higher levels of depressed mood are associated with risk for alcohol use initiation without parental permission among adolescent boys.

Keenan (2008) (6)	n = 2,451	9	At age 11	Minor depression (DSM-IV): individual depressive symptoms	Minor depression is longitudinally stable. An increase in the number of symptoms increases the risk for future depression and impairment
Mrugham (2008) (103)	n = 345	13–14	At age 20	Individual depression symptoms	In the bivariate analysis, depressed mood is associated with later self-harm, but the association does not hold in the multivariate analysis.
Van Voorhees (2008) (91)	n = 4,791	11–20	1 year	52 variables, including individual depression symptoms	Feeling sad, being unable to 'shake off the blues', and feeling depressed are among the top 5 variables predicting future depression.
Georgiades (2006) (9)	n = 1,456	14–18	1 year	Individual depression symptoms (DSM-III)	Sad mood contributes unique variance to the prediction of MD onset.
Fergusson (2005) (41)	n = 1,006	17–18	At age 25	SD: Depressed mood/ anhedonia ≥ 2 wks, not meeting MD criteria	SD predicts later depression, suicidal behaviours, and treatment-seeking. The risk is elevated as much as with MD when compared to asymptomatic individuals.
Wittchen (2000) (40)	n = 1,228	14–17	5 years	Symptomatic: ≥ 1 core symptom; SD: MD criteria met except for one key criteria	A 'symptomatic' status at baseline increases the risk for future SD, MDD, and anxiety disorders. A 'subthreshold' status at baseline increases the risk further.
Oledehinkel (1999) (104)	n = 1,228	14–17	20 months	SD: MD criteria met except for one key criteria	SD is associated with impairment, having been unable to work, MD, dysthymia, suicidal ideation and having received professional help at follow-up; the outcomes are very similar to MD.

BDI = Beck's Depression Inventory; BEAA = Body Esteem Scale for Adolescents and Adults; CBCL = Child Behaviour Checklist; CDI = Children's Depression Index; CDRS-R = Children's Depression Rating Scale – Revised; CES-D = The Center for Epidemiologic Studies of Depression; DD = Depressive Disorder; DSM = Diagnostic And Statistical Manual Of Mental Disorders; GAD = generalised anxiety disorder; GAF = global assessment of functioning; ETI = Emotional Tone Index; MD = major depressive disorder; PTSD = post-traumatic stress disorder; SD = subthreshold depression; SDQ = Strengths and Difficulties Questionnaire; SMFQ = Short Mood and Feelings Questionnaire; SPI = standardised psychiatric interview; YSR = Youth Self Report

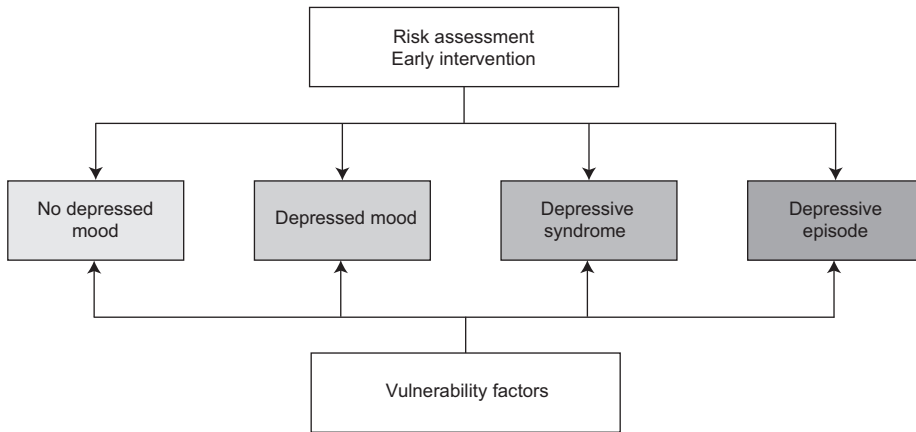


Figure 1. A model of early risk assessment and intervention along the depression continuum, adapted from Van Voorhees' (91) work

subthreshold depression during childhood or adolescence in a longitudinal setting are summarised in *Table 1*.

Only a few studies have examined depressed mood, but it has been found to predict anhedonia, a relatively specific symptom of depression (91), as well as major depression in adolescent and adult populations (10,11). In a study of Dutch adolescents, Van Voorhees and colleagues (92) constructed a model for depression risk assessment. From the 52 variables chosen for further examination, three symptoms describing depressed mood (i.e., feeling sad, being unable to 'shake off' the blues, and feeling depressed) were found to be among the top five variables predicting depression 1 year later. Their illustration of early risk assessment and intervention is presented in *Figure 1*.

However, in a study of 10–15-year-old youth, depressed mood was not among the top four symptoms as defined by short Mood and Feelings Questionnaire items that best predicted high depressive symptoms 1 year later, although it was associated with it (59). In another study of 11–12-year-olds followed up for six years, changes in the participants' level of depressed mood did not predict future depression (93).

Taken together, while subthreshold depression has been repeatedly associated with a range of adverse outcomes, the studies examining the significance of depressed mood specifically have, thus far, been few and produced discrepant results. Prior studies warrant more research on current and future significance of depressed mood.

2.2 FACTORS ASSOCIATED WITH EMOTIONAL PROBLEMS AND DEPRESSED MOOD IN CHILDREN

2.2.1 Overview of factors associated with emotional problems

Emotional problems emerge and evolve in the interplay of multiple genetic and environmental risk and protective factors (38). Anxiety and depression symptoms share many of the same associated risk and protective factors, but some are also distinct (106,107). Emotional problems in childhood are moderately heritable, and high heritability is associated with some preschool anxiety disorders (108). Furthermore, environmental factors, such as parenting, family distress, and social disadvantage, play an important role in the emergence of childhood emotional and behavioural problems (109).

Parental psychological disorders, especially maternal depression and anxiety, are established risk factors for childhood emotional problems (106,110,111). Parental depression and anxiety increase the risk of emotional problems, both directly and indirectly, through attachment, parenting, and modelling, for example (106,112). For example, unsupportive, rejecting, and overinvolved parenting and harsh discipline are all associated with emotional problems in childhood (109–111,113,114).

Childhood deprivation and abuse are risk factors for several developmental problems, as well as childhood emotional problems, and have long-standing effects (111,115). The effects of deprivation and abuse on the emergence of emotional problems and disorders have the potential to be conveyed via various mechanisms, such as structural and functional alterations of the brain and the dysregulation of stress responses; hence, disturbances in social and cognitive development may result from neglect and abuse (116). Regarding other family-related stress, not living with both parents, a low socioeconomic status, parental unemployment, multiple relocations, and having many siblings are associated with emotional problems (53,106,110,117). Bullying, having few close friends, academic difficulties, stress, and daily hassles, have also been found to be associated with emotional problems (117,118).

Environmental adversities impact and interact with a child's individual characteristics. Certain aspects of temperament, which refers to biologically-based individual differences in self-regulation and reacting (119), are associated with emotional problems (120–122). High negative affectivity, denoting experiences of distress and uneasiness in engaging with the environment, is associated with both depression and anxiety (120,121), whereas low levels of positive affectivity (i.e. pleasurable engagement with the environment and the aptness to feel enthusiastic and active) are closely associated with depression (123). In addition, behavioural inhibition, a fearful and novelty-avoidant way of reacting, is associated with anxiety, especially, as well as with depression (124,125).

Elevated levels of emotional symptoms are also associated with some medical conditions, such as diabetes (126), epilepsy (127), and inflammatory bowel disease (128). Furthermore, developmental motor and speech problems, reading disability, and learning difficulties, more generally, are associated with emotional problems (53,129,130). Additionally, individual differences in attention and executive functioning, which includes inhibitory control, working memory, updating and set-shifting, are associated with emotional problems, and these seem to differ between depression and anxiety (27,131,132). The literature regarding the association between emotional problems and inhibitory control will be further reviewed in Section 2.2.4.

2.2.2 Co-occurrence of emotional problems, conduct problems, and hyperactivity

Comorbidity is a typical feature of psychopathology (133,134). Epidemiological studies involving population-based samples suggest that on average, 26–29% of youth with a psychiatric disorder also have at least one additional concurrent disorder (53,135,136). In a longitudinal study, 66% of the individuals with one disorder at some point also had at least one additional disorder at the 25-year follow-up (137). Comorbidity typically takes place either between emotional disorders, for example, between depression and anxiety disorders or between ADHD and disruptive behaviour disorders (134,136). However, comorbidity is frequent also between an emotional disorder and ADHD or a disruptive behaviour disorder, and some studies suggest that in that case the emotional disorder is more often depression than an anxiety disorder (39,134,136).

Findings of trajectory studies suggest that while some children follow a path of ‘pure’ internalising symptoms, some children exhibit co-occurring internalising and externalising symptoms in early childhood (43,138,139). Additionally, some children develop co-occurring symptoms later on, in addition to the initial symptoms, and in some cases, the symptoms evolve from one type to another (43). The commonness of heterotypic comorbidity and continuity, which refer to the simultaneous or sequential occurrence of different types of symptoms and disorders, has led some researchers to suggest there might be one underlying factor creating vulnerability for all types of psychopathology (137). The general tendency to develop any kind of psychopathology during the life course has been conceptualised as a single dimension named the p-factor (137).

Assessing co-occurring symptoms of different disorders has several implications. First, when attempting to identify depression, behavioural symptoms pose a diagnostic challenge. It has been found that among 6–17-year-old youth diagnosed with depression, the original reasons for consultation were behaviour problems in 32–59% of the boys and 26% in the whole sample (140). Second, the co-occurrence of emotional and behaviour problems is associated

with more adverse outcomes compared to children with ‘pure’ symptoms, in both population-based (139,141–143) and clinical samples (144–146). Identifying comorbidity is often significant for the successful treatment of psychological disorders (147–149).

Relatively few studies have focused on the comorbidity of subthreshold conditions among youth. One study found that depressive symptoms are more common among 6–8-year-old children with ADHD than among controls; for example, 32% of the children with ADHD experienced sadness, compared to 14% of the controls (150). Early co-occurring emotional and behavioural symptoms among children with ADHD increase the risk for adolescent depression and suicide attempts (151).

One study focused on the comorbidity of subthreshold disorders among adolescents (39). In the sample, 40% of the adolescents with a subthreshold condition had at least one other comorbid subthreshold condition, and 36% had a lifetime diagnosis of a comorbid disorder meeting the criteria for a full syndrome. In their study, full syndrome depression was associated with all the examined subthreshold conditions. Subthreshold depression, on the other hand, was associated only with subthreshold anxiety but not any full syndrome conditions.

However, the approach to comorbidity in clinical samples remains, for the most part, categorical. The prevalence and significance of co-occurring symptoms that fail to meet the criteria for a distinct comorbid disorder remain largely unknown. In this study, we examine the prevalence and co-occurrence of emotional and behavioural problems in population-based and clinical samples. In the clinical sample, we also examine the prevalence of depressed mood among children with diagnosed depression, anxiety, ADHD, and ODD/CD.

2.2.3 Emotional symptoms and sleep problems

Sleep problems are frequent among children, as they are reported in 22–43% of the children in population-based studies (152–155). Furthermore, children with somatic or mental health problems tend to have more sleep problems compared to healthy children (156–158). The general concept of sleep problems covers various phenomena, including insomnia (i.e., difficulty falling asleep or maintaining sleep), hypersomnia, irregular sleep times or duration, parasomnias, breathing-related sleep disorders, oppositional behaviour at bedtime, and poor sleep (14). Sleep problems can be assessed using subjective data reported by parents or children and objective measures, most commonly polysomnography (PSG) or actigraphy (159). The information from these different sources is usually quite discrepant, correlating only weakly or moderately (19,20,152,155,160,161). However, the different methods should be regarded as complementing each other rather than as competing, and a variety of methods is necessary to detect the different aspects of sleep problems (159).

Emotional symptoms have been repeatedly demonstrated to be associated with sleep problems in population-based samples of youth, both concurrently (162–166) and longitudinally (167–169). In cross-sectional studies, emotional symptoms are associated with short sleep duration (164,170), sleep-onset latency (171), irregularity in sleep duration (172), adverse bedtime behaviours and daytime sleepiness (173), and subjective poor sleep quality (174). A longitudinal study of Finnish children found that sleep problems at 3–6 years of age predicted anxious/depressed mood at ages 7–11 and that the risk was especially elevated among those whose sleep problem had persisted from the first assessment until follow-up (8.5% of the sample) (169).

Studies that combined subjective and objective measures of sleep have provided interesting results on the patterns of associations between emotional symptoms and sleep. In a sample of 5–12-year-old children, Calhoun and colleagues (175) found that the association between insomnia symptoms and mental health problems is moderated by objective sleep duration. Children had more emotional problems if insomnia symptoms were accompanied by short sleep measured with polysomnography, whereas insomnia symptoms with normal sleep duration were associated with externalising symptoms, inattention, school problems and mood variability. A similar study of a sample of adolescents aged 12–23 years yielded analogous results (176). Bei et al. (174) found that poor sleep quality mediated the relationship between objectively detected sleep problems and negative mood. Adolescents with objectively measured sleep problems reported more feelings of negative mood only if they had a subjective experience of poor sleep. Other researchers have examined the short-term effects of sleep problems on subsequent mood and found that inadequate sleep, even for only a few days, worsens mood and decreases an individual's capacity to regulate negative emotions (177).

Sleep problems are frequently reported among youth with depression (MDD) (14,29,30,178). According to subjective reports, up to 90% of children with depression have sleep problems (29). Sleep disturbances have also been detected via objective measures, but the findings have been mixed and the detected associations mostly modest (179). According to a meta-analysis, there is support for differences between depressed youth and controls in sleep onset latency, total sleep times, sleep efficiency, REM latency, and total REM time, as well as differences in sleep microarchitecture (179). However, the evidence of objectively detectable sleep problems is not robust, as these types of studies have, typically, found no significant differences (179). It has been suggested that depressed youth might report sleep problems more frequently due to the negative cognitions associated with depression, which may influence self-reported sleep data (14). However, it has also been proposed that the discrepancy between high levels of subjective sleep problems and the lack of findings on objective measures might be due to the latter's insufficient sensitivity (14).

Results of longitudinal studies are also discrepant. Sleep problems in childhood or adolescence have been found to predict depression, even in adulthood (180,181). Some results suggest reciprocal relationships exist between insomnia and depression or depressive symptoms (97), while other results imply that sleep problems are a precursor of depression, but not vice versa (182,183). Childhood anxiety and depressive symptoms have been found to predict insomnia in adulthood (184), although some studies have not found sleep problems to predict later depression (185,186).

Anxiety disorders are also strongly associated with sleep problems (187). In a population-based US study, GAD and separation anxiety disorder were cross-sectionally and independently associated with sleep problems, and the longitudinal examination suggested a reciprocal association (168). In a series of studies of clinical samples of youth with anxiety disorders, parents reported sleep problems in 85–88% of the youth with any anxiety disorders and in 98% of the youth with GAD (188–190). According to self-reports, 54% of youth with any anxiety disorder and close to 90% of the youth with primary GAD have difficulty sleeping (190). Some sleep parameters of children with anxiety disorders have also been shown to differ from those of healthy controls in PSG studies (191,192). They also found that anxious youth have greater depressive and anxiety symptoms, a more negative daily affect, more somatic complaints, and higher levels of physiological hyperarousal than controls, and these differences are moderated by objectively observed sleep characteristics (192). However, they found no significant differences between children with GAD and controls when measured by actigraphy, although significantly more subjective sleep problems were reported by children with GAD than controls (19). In a similar study, Mullin et al. compared sleep parameters in 12–18-year-old adolescents with GAD and healthy controls via actigraphy and sleep diaries. (193). They found longer sleep onset latency in adolescents with anxiety than in controls, according to both the actigraphy and sleep diary data. Adolescents with GAD reported other problems related to sleep, including excessive fears and worries at bedtime, restless legs during sleep, and daytime sleepiness. The results of actigraphy measures associated with parent-reported symptoms of depression and anxiety in the adolescents indicate a significant negative association exists between sleep efficiency and depression symptoms, and a positive association exists between sleep onset latency and both depression and anxiety symptoms. However, no significant associations between sleep variables and self-reports of anxiety or depression were found. A study of 16–18-year-old adolescents with anxiety symptoms found that a sleep intervention was effective in reducing anxiety in this sample (194).

Some studies suggest emotional comorbidities play an important role in the sleep problems of children with ADHD (157,195–199). Sleep problems and emotional comorbidities are prevalent in children with ADHD (200–203). In a series of studies of 5–13-year-old ADHD patients, children with concurrent inter-

nalising and externalising comorbidities were found to be at increased risk for moderate or severe sleep problems compared to children without comorbidities (204). Comorbidity was closely associated with persistent sleep problems, while transient sleep problems were also common in children without comorbidities. It was also found that the association between sleep problems and emotional problems is bidirectional (205). Regarding ODD and CD, a longitudinal population-based study in the US suggests that the association between CD and sleep problems is accounted for by emotional comorbidity, but that there is an independent association between ODD and sleep problems (168). A previous Finnish study involving a clinical sample found that children with disruptive behaviour disorders have more sleep problems than controls, and this association is not accounted for by comorbid emotional disorders; however, the effect of comorbid emotional symptoms was not examined dimensionally (206).

In the current study, we are especially interested in sleep from the child's perspective. Asking children about their sleep has been encouraged, as they may provide information that is not included in parent reports (160,165). In a previous Finnish study of a sample of 8–9-year-old children, as much as 95% of the severe sleep problems were reported by the children and were not included in the parent reports (165). Nevertheless, children's self-reports regarding sleep have been examined in a minority of sleep-related studies, especially in clinical samples. While subjective disturbances in sleep have been found in association with emotional symptoms and disorders, the lack of studies with child self-reports can be considered a major gap in the literature.

2.2.4 Internalising symptoms and inhibitory control

Inhibitory control (IC) refers to the ability to stop or withhold a pre-potent or a dominant response (207). Along with updating working-memory representations and set-shifting, IC is one of the executive functions (EFs), which are, in turn, cognitive top-down regulatory processes aimed at goal-directed behaviour (208). EFs share a common base that captures the shared variance of the different functions (209). Then, functions are also, to some extent, separable because of their unique variance (209). Factor analytic studies of the structure of EF among adolescents and adults suggest that IC shares all its variance with the common EF base and is not separable into its own domain (208). In childhood samples, the literature regarding the unity and diversity of EFs is more mixed (210). Many studies suggest that EFs are best described as a single domain based on preschool or middle childhood samples (211–214), while separable domains have also been found in these age groups (215,216).

EFs and related skills develop in a hierarchical way, with lower-level or fundamental abilities developing first and more complex capacities developing on top of the acquired skills in a cascading manner (217–219). The simplest form of IC is a low-level function that emerges in the first years of life and is consid-

ered an important basis for the development of more complex functions as the child matures (218,219). IC is a component of self-regulation, the intrinsic dynamic modulation of one's own behaviour or internal state (21). Self-regulation is considered crucial to mental health (21). Inhibitory control (IC) skills have been associated with a wide range of social, academic, and psychological outcomes (207,220–222).

Original research studies have yielded mixed findings on the associations between IC and emotional symptoms and disorders (22,24,132,223–225). In cross-sectional studies, more advanced IC skills have been found to be associated with fewer emotional symptoms in 4–5-year-old children (223), and in a sample of 8–12-year-old children among the 8–10-year-olds (22). Then, another study found an association in a sample of 10–12-year old children but only among girls (224). In a longitudinal study, IC and emotional symptoms were not concurrently associated at age 6, but IC deficits at 6 were associated with emotional symptoms at age 9 (225), while in another study, IC deficits at preschool-age were found to be associated with greater depression and anxiety severity at the 7.5 year follow-up (24). The longitudinal studies examining prospective associations of inhibitory control in childhood and future emotional outcomes are presented in *Table 2*. Furthermore, regarding the common EF domain, a negative association has been found between the common EF performance at age 5 and depression and anxiety symptoms an average of 4.7 years later (226), as well as a concurrent negative association in a longitudinal study of adolescents aged 17–23 (227). Regarding inhibitory control deficits in major depression, results suggesting IC deficits among patients have been found (228), although the absence of significant differences, when compared to controls, has also been reported (229).

While some studies suggest that IC deficits are associated with anxiety (24), meta-analyses do not support an association (27,230); however, *high* IC has been found to be associated with anxiety (131,231). High IC has been suggested to be a risk factor, especially for children who show behavioural inhibition (i.e., a temperament style with an easily activated fear and novelty-avoidant approaching behaviour) (131,232). For these children, overcontrol is due to two different control systems, involuntary, automatic reflex-like behavioural inhibition and executive, voluntary IC (124), causing rigidity and a decreased ability to regulate behaviour, which intensifies a child's experience of anxiety (131,232). Overall, evidence of associations among IC, emotional symptoms, and disorders are mixed, and the direction of the longitudinal associations remains unclear.

First, IC deficits have been suggested to be a *risk factor* for emotional psychopathology, and longitudinal studies have found IC deficits to predict future emotional symptoms (24,224,225). It has been theorised that IC deficits contribute to depression and anxiety by facilitating rumination and negative

biases in attention (24,233,234). It has also been proposed that the association between IC and depression reflects a more pervasive impairment in the dopaminergic pathways between the prefrontal cortex and the striatum (224), which are also involved in, for example, reward sensitivity, a process that is often blunted in individuals who have or are at risk for depression (224,235). Furthermore, an association between IC deficits and shyness, as well as poorer social competence, has been found (223,236), which, in turn, poses a risk for emotional symptoms (237). It has also been proposed that an association between IC deficits and poor mental health is found because good IC protects an individual from or compensates for other risk factors, making IC deficits a contributory rather than a causal risk factor for emotional problems (238–240). For example, adolescents with greater IC and mental flexibility have been shown to experience fewer depressive symptoms when exposed to a parental depressive episode, while adolescents with poorer IC experience more depressive symptoms (239). In another study, children with fearful inhibition experiencing high maternal negative behaviours had more emotional symptoms only if they also had low IC (238).

Second, IC deficits could be a *complication* of emotional psychopathology. This hypothesis has not been examined in childhood even though, especially in childhood, the developmental processes of the brain could be altered by aberrant symptoms or disorders (241). De Raedt and Koster (26) developed a model that combines evidence of the cognitive and biological aspects of adulthood depression. According to the model, IC deficits increase during depressive episodes due to biological cascades and do not fully recover during remission, thus making the individual more vulnerable to recurrent episodes. Longitudinal studies using cross-lagged designs are needed to examine this hypothesis in childhood (28).

Finally, IC deficits and emotional symptoms may be *associated at the trait level* because they are both associated with a third variable, such as a common cause or some other shared link, or because of overlap in the variables. The findings of a recent twin study suggest that IC is an inseparable element of the common EF base, and its highly heritable deficits are associated with depressive symptoms in a trait-like manner, supporting a common genetic background for both of them (227). Then, several environmental factors, such as preterm birth, parenting styles, prenatal drug or alcohol exposure, and socioeconomic status have been associated with IC deficits (242–246) and mental health problems (247–250), suggesting that there may also exist shared environmental factors explaining the correlation between IC deficits and emotional problems.

In this study, we test three hypotheses regarding the possible association between IC and emotional problems. First, we test the hypothesis that inhibitory control deficits are an underlying risk factor of emotional problems

Table 2. Longitudinal studies examining prospective associations of inhibitory control in childhood and future emotional outcomes

Author	Sample	Age (T_0)	Time to / age at last follow-up	IC measure	Result
Liu (2018) (237)	n = 218	2	Age 6	Crayon delay task Tongue task	The interaction between low IC and highly negative maternal behaviours mediates the association between fearful inhibition at age 2 with internalising symptoms at age 6.
Kertz (2016) (23)	n = 188	3–6	7.5 years	BRIEF-P/BRIEF	IC deficits in preschool-aged children are associated with later, more severe depression and anxiety.
Anzman-Frasca (2015) (22)	n = 192	7	Age 9–15	IC subscale of the CBQ	Higher IC is associated with lower levels of depressive symptoms.
Van Deurzen (2012) (223)	n = 2,179	10–12	5 years	Visual Attention Set Shifting task	IC deficits are cross-sectionally and longitudinally associated with affective problems in girls.
White (2011) (130)	n = 152	48 months	Age 5	Stroop task, IC subscale of the CBQ	High levels of IC mediate the association between toddler behavioural inhibition and preschool anxiety.
Riggs (2003) (224)	n = 60	6	Age 9	Stroop Color Word, WISC-R Coding Task	Baseline IC is associated with later parent-reported internalising symptoms. IC and internalising symptoms are not concurrently associated at baseline.

CBQ = The Child Behaviour Questionnaire; IC = inhibitory control; BRIEF(-P) = Behaviour Rating Inventory of Executive Function (Preschool Version); WISC-R = Wechsler Intelligence Scale for Children-Revised.

(i.e., whether, using a random intercept cross-lagged panel model, changes in inhibitory control performance predict subsequent changes in emotional symptoms at the within-person level). Second, we test the hypothesis that inhibitory control deficits emerge as a complication of emotional symptoms (i.e., whether changes in emotional symptoms predict subsequent changes in inhibitory control at the within-person level). Finally, we test the trait hypothesis (i.e., whether emotional problems and inhibitory control performance are associated at the between-person level). We also examine the moderating effects of age and gender, as previous studies suggest that the association between IC and emotional problems may vary depending on age (22) and gender (224).

3 AIMS OF THE PRESENT STUDY

Emotional symptoms and subthreshold depressive conditions are common in children. There is a concern that children who are impaired by these symptoms may not be recognised as such and, thus, do not receive adequate treatment. Even without current impairment, these symptoms may result in the development of more severe disorders in the future. Early recognition of these symptoms could be helpful in preventing disorders from developing and complications in present disorders.

This study has the following aims:

- 1 To determine the prevalence of emotional problems and depressed mood in a community sample of Finnish children aged 4–12, as well as the characteristics of these children and their families.
- 2 To determine the prevalence of children with emotional problems and depressed mood in a sample of Finnish child psychiatric outpatients aged 6–12 years, as well as the impact of these symptoms on their level of functioning.
- 3 To examine child reports of sleep and their association with emotional symptoms in child psychiatric outpatients aged 6–12 years.
- 4 To examine the cross-lagged associations between inhibitory control skills and internalising symptoms in a Finnish community sample of children aged 7–11 years.

4 MATERIALS AND METHODS

4.1 PARTICIPANTS

4.1.1 Participants in Study I

Study I was conducted on a community sample of Finnish children. An initial sample of 5,000 children representative of Finnish children aged 4–12 years was formed at Statistics Finland based on their residential area and age. The collection of the data took place in March and April of 2009. Mothers, or if the child was not living with their mother, other primary caretakers, were sent a contact letter with information about the study. The participants were asked to complete a background questionnaire that includes questions about the parents' education and employment status and the child's somatic health and sleep, as well as the Strengths and Difficulties Questionnaire (SDQ) as a measure of the child's mental health. They were given the option of responding via an internet-based individual password-protected interface (Digium) or by completing and mailing a paper version. After sending two reminders, the response rate was 34.3%, yielding a final sample of 1,714 children. The final sample was well representative of the initial sample with respect to gender distribution and residential area. The sample is described in greater detail in *Table 3*.

4.1.2 Participants in Studies II–III

Studies II and III were conducted on a child psychiatric patient sample. We formed the samples by including all patients attending the child psychiatric assessment and acute care unit of Helsinki University Hospital between 6 August 2013 and 3 December 2015 ($n = 1,251$). We collected data from the hospital register, which includes information on each patient's age, gender, and diagnoses, as well as scores on the parent-rated SDQ and the child-rated quality-of-life questionnaire 17D, which, at the time, were routinely collected from patients on admission. In Study II, we included patients with complete SDQ data and excluded those who were aged ≤ 4 or ≥ 13 , yielding a final sample of 862 patients. The sample did not differ from the initial patient population on age, sex, or CGAS values. The study sample's descriptive statistics are presented in *Table 4*.

In Study III, we included all patients for whom both the SDQ and the 17D had been completed ($n = 432$). We set the age range to 6–12 years by excluding the single 14-year-old patient as an outlier. The included sample ($n = 431$) did not differ from the excluded children ($n = 819$) regarding gender or diagnoses (ICD-10), with the exception of depression, which was more common among the children included in the study (12.3% vs 7.3%, $p = .004$). This sample's descriptive characteristics are presented in *Table 5*.

Table 3. Descriptive statistics of participants in study I (n = 1,714)

Child characteristics		Residential area	n (%)
Age in years, mean (SD)	7.9 (2.3)	Major city	659 (38.4)
Preschool-age, n (%)	668 (39.0)	Medium-sized city	737 (81.5)
School-age, n (%)	1046 (61.0)	Small city/town	316 (18.5)
Girls, n (%)	869 (50.7)		
Boys, n (%)	845 (49.3)		
Sleeping problems, n (%)	246 (14.4)		
Illness or disability, n (%)	262 (15.3)		
Parents' marital status	n (%)	Living with the child	n (%)
Marriage	1159 (67.6)	Mother	1688 (98.5)
Divorced/lives separately	268 (15.6)	Father	1436 (83.8)
Common-law marriage	259 (15.1)	Siblings	1454 (84.8)
Other	23 (1.3)	Stepmother	10 (0.6)
Information unavailable	5 (0.3)	Stepfather	102 (6.0)
		Grandparent	6 (0.5)
Parents' occupation	Mother n (%)	Father n (%)	
Managers	32 (1.9)	136 (7.9)	
Managerial employee	314 (18.3)	401 (23.4)	
White collar	487 (28.4)	264 (15.4)	
Entrepreneurs	109 (6.4)	292 (17.0)	
Blue collar	666 (38.9)	563 (32.8)	
Student	52 (3.0)	7 (0.4)	
Retired	5 (0.3)	17 (1.0)	
Information unavailable	49 (2.9)	34 (2.0)	

4.1.3 Participants in Study IV

The sample in Study IV was originally formed for an intervention study that examined the effects of a school-based intervention program called ‘Together at School’, which was designed to support mental health and socioemotional skills in the general population (251). All Finnish primary schools that met the following criteria were invited to participate in the study: at least two teachers teaching either 1st, 2nd, or 3rd grades who could participate for the full 18-month duration of the longitudinal study with data collected during the autumn term of 2013 (T1), at 6 months during the spring term of 2014 (T2), and at 18 months during the spring term of 2015 (T3). Applying these criteria resulted in an initial sample of 3,952 children from 79 schools. We included

Table 4. Descriptive statistics of the patients in Study II (n = 862)

		Diagnosis, n (%)	
Age in years, mean (SD)	9.1 (2.0)	ODD/CD	224 (26.0)
Range	5–12	Hyperkinetic disorder	152 (17.6)
Interquartile range	4	Childhood emotional disorders (other/NOS)	136 (15.8)
Preschool age, n (%)	105 (12.2)	Anxiety disorder	114 (13.2)
School age, n (%)	757 (87.8)	Depression	99 (11.5)
Girls, n (%)	313 (36.3)	Learning disability	70 (8.1)
Boys, n (%)	549 (63.7)	Post-traumatic disorder	61 (7.1)
CGAS on arrival (n = 849)		Autism spectrum disorder	57 (6.6)
		Somatic diagnosis	31 (3.6)
		Obsessive-compulsive disorder	23 (2.7)
		Eating disorder	23 (2.7)
		Sleeping problem diagnosis	21 (2.4)
Mean (SD)	53.2 (8.1)	Other diagnosis	115 (13.3)
Median	52.0		
Range	21–92		
Interquartile range	12		

Table 5. Descriptive statistics of the patients in Study III (n=431)

	Whole sample n = 431	ODD/CD n = 105	ADHD n = 77	Anxiety n = 59	Depression n = 53
Girls, n (%)	160 (37.1)	24 (22.9)	15 (19.5)	33 (55.9)	23 (43.4)
Boys, n (%)	271 (62.9)	81 (77.1)	62 (80.5)	26 (44.1)	30 (56.6)
Age, mean (SD)	9.7 (1.6)	9.2 (1.7)	9.0 (1.5)	10.1 (1.5)	10.6 (1.4)

SD = standard deviation; ODD = oppositional defiant disorder; CD = conduct disorder; ADHD = attention deficit/hyperactivity disorder.

all children with data on the go/no-go performance test or SDQ scores at a minimum of one time-point, as well as data on the included covariates: age, gender, and SES (n = 2,874).

In total, we obtained data on 2,508 (87.3%) children and 2,460 (85.6%) parents at T1, 2,759 (96.0%) children and 2,239 (77.9%) parents at T2, and 2,580 (89.8%) children and 1,853 (64.5%) parents at T3. Data were available at all time points for 2,184 (76.0%) children and 1,405 (48.9%) parents, two time points for 605 (21.1%) children and 874 (30.4%) parents, and a single time point for 85 (3.0%) children and 589 (20.5%) parents.

The included children (n = 2,874) did not differ significantly from the excluded children (n = 1,078) on gender ($\chi^2(1) = 0.767, p = .381$) or go/no-go

commission error rates at baseline ($U = 819539.50$, $p = .105$). However, the included children were slightly younger ($M = 8.16$, $SD = 0.82$) than the excluded children ($M = 8.37$, $SD = 0.98$; $t = 5.65$, $p < .001$).

The sample's descriptive statistics at T1, T2, and T3 are presented in *Table 6*.

4.2. MEASURES

4.2.1 The Strengths and Difficulties Questionnaire (Studies I–IV)

As a measure of psychiatric symptoms, in all the studies, we used the Strengths and Difficulties Questionnaire (SDQ), a brief screening tool used to measure emotional and behavioural problems and strengths in children and adolescents (31). Several alternative versions of the questionnaires are available for different purposes, while the main outline of the content is similar from one version to another. All the versions include 25 items regarding psychological attributes and, optionally, an impact supplement to complement the evaluation of symptoms. In this study, we used the parent version, designed for parents of 4–17-year-olds.

The items are rated either ‘not true’, ‘somewhat true’, or ‘certainly true’ and scored from 0–2, respectively, except for five items scored in the opposite di-

Table 6. Descriptive statistics of participants in Study IV ($n = 2,874$)

Variable	T1	T2	T3
Boys, n (%)	1,291 (48.1)	1,351 (48.6)	1,249 (47.9)
Girls, n (%)	1,393 (51.9)	1,429 (51.4)	1,359 (52.1)
Age, M (SD)	8.16 (0.82)	8.69 (0.82)	9.68 (0.82)
SES, n (%)	2,451 (88.0)	2,248 (80.7)	1,859 (66.8)
SES 1, n (%)	234 (9.5)	231 (10.3)	190 (10.2)
SES 2, n (%)	591 (24.1)	543 (24.2)	425 (22.9)
SES 3, n (%)	1,038 (42.4)	950 (42.3)	808 (43.5)
SES 4, n (%)	428 (17.5)	372 (16.5)	315 (16.9)
SES 5, n (%)	111 (4.5)	102 (4.5)	83 (4.5)
SES 6, n (%)	49 (2.0)	50 (2.2)	38 (2.0)
SDQ, n (%)	2,460 (88.4)	2,240 (80.5)	1,853 (66.6)
Emotional score, M (SD)	1.28 (1.48)	1.25 (1.49)	1.30 (1.60)
Peer problems score, M (SD)	1.59 (1.49)	1.55 (1.51)	1.56 (1.54)

M = mean; SD = standard deviation; SES = socioeconomic status (measured by asking, ‘When including all the income in your household, how easy is it to cover expenses?’; Likert scale responses range from 1 = very easy to 6 = very difficult); SDQ = Strengths and Difficulties Questionnaire.

rection. The items are sorted into five subscales of scores ranging from 0–10. The four problem subscales (i.e., emotional problems, conduct problems, hyperactivity, and peer problems) form the total problems score, ranging from 0–40, while the prosocial scale representing strengths is interpreted individually. We used this scoring method on five subscales in Studies I–III. In Study IV, we combined the emotional and peer problems subscales to create a broader internalising subscale by summing their scores and summed the conduct problems and hyperactivity subscale scores to create an externalising subscale, which may be done in low-risk samples (252). We created these subscales to reduce the complexity of data analysis in Study IV.

In Studies I–III, the SDQ subscores were categorised as ‘normal’, ‘borderline’, or ‘abnormal’ based on the cut-off points defined in the original United Kingdom (UK) sample and available on the official SDQ website: scores 0–3 were defined as a normal emotional problems score, score 4 a borderline score, and scores 5–10 an abnormal emotional problems score. Regarding conduct problems, scores 0–2, 3, and 4–10, and regarding hyperactivity, scores 0–5, 6, and 7–10 were defined as normal, borderline and abnormal, respectively (253). Regarding the individual items, we collapsed the ‘somewhat true’ and ‘certainly true’ categories into one category to gain more statistical power.

The SDQ is widely used in research, as well as in clinical practice. It is considered a useful tool in identifying existing problems and has predictive value over time (76,254). The SDQ has also been found to be a useful screening tool in epidemiological research and clinical practice in Finnish populations (67).

For the samples in this study, Cronbach’s alphas ranged from .65–.72 for the emotional subscale, .64–.74 for the conduct problems subscale, .81–.84 for the hyperactivity subscale, .61–.67 for the peer problems subscale, and from .69–.77 for the prosocial subscale in Studies I–III using the five subscale scoring method, from .66–.72 for the broad internalising subscale, and from .81–.82 for the externalising subscale in Study IV.

In addition to the subscales, in Studies I–II we used the item ‘often unhappy, down-hearted, or tearful’ from the SDQ as a measure of depressed mood (or low mood, as in the original publications). The somewhat and certainly true categories were combined into one ‘true’ category.

4.2.2 17D (Studies II–III)

As a measure of child-reported symptoms, we used the 17D questionnaire, a self-administered instrument for measuring children’s health-related quality of life, developed especially for children aged 8–11 years. It is based on 15D, a measure used for adult populations (255). It includes 17 dimensions of child health and experiences of the child’s capability in everyday activities.

As a measure of child-reported depressed mood, we used the depression dimension of the 17D (Question 17). Question 17 asks the child to choose whether

they feel cheerful and happy or a little/quite/very/extremely sad, unhappy, or depressed. Reports of feeling at least a little sad, unhappy, or depressed were interpreted as current depressed mood.

As a measure of child-reported sleep problems, we used the sleep dimension of the 17D (Question 5). The sleep dimension has five categories: 1) 'I fall asleep easily, and I sleep well', 2) 'It is sometimes hard to fall asleep, or I sometimes have nightmares or wake up at night', 3) 'It is often hard to fall sleep, or I often have nightmares or wake up at night', 4) 'It is nearly always hard to fall asleep, or I have nightmares or wake up almost every night', and 5) 'I am awake most of the night'. From the five categories, we formed a dichotomous variable (i.e., the child reports a sleep problem, yes/no) based on the distribution of the answers: normal sleep (categories 1 and 2) and sleep problems (categories 3, 4, and 5). Thus, having a sleep problem was defined as the child often or frequently experiencing difficulties falling asleep, nightmares, or waking during the night.

4.2.3 The International Classification of Diseases, 10th edition (Studies II–III)

Diagnoses used to group patients in Studies II–III were set by the clinician in charge of the initial evaluation of the patient in the child psychiatric assessment and acute care unit of Helsinki University Hospital. Initial diagnoses were set according to *The International Classification of Diseases*, 10th edition (ICD-10) (1) after an evaluation, which included information from the referral, an anamnestic interview with the child and the parents by the child psychiatrist, and brief one-on-one discussions with the parents and child. For the purposes of this study, we combined the detailed diagnoses into diagnostic groups by assigning a diagnostic group for each ICD-10 code. The following groups were used in the further analyses: Depressive disorders (F32, F39, F92.0), Anxiety disorders (F40–F41, F42.1, F93.0–F93.2, F93.80, F21.9), Hyperkinetic disorders, (F90), Conduct disorders (ODD/CD; F90.1, F91–F92, F63.9), and Sleep disorders (F51).

4.2.4 The Children's Global Assessment Scale (Study III)

As a measure of each child's impairment, we used the Children's Global Assessment Scale (CGAS). It is a continuous rating scale ranging from 0–100 and assesses the severity of disturbance in children with psychiatric symptoms (256). A higher score indicates a lower level of impairment. It takes into account the child's capacity to participate in typical, age-appropriate activities, as well as the need for support, surveillance, and treatment, thus providing a dimensional appraisal of the level of the child's well-being, in addition to the classifying diagnosis. The inter-rater reliability of CGAS ranges from fair to substantial, with training of the raters improving the reliability (257,258).

The test-retest reliability has also been at least moderate, although this has been examined less (258). CGAS is useful in measuring change over time but the findings of its predictive value are mixed (258). The CGAS ratings used in this study were set by the treating clinician after an initial evaluation. See also *Figure 2*.

4.2.5 The go/no-go task (Study IV)

As a measure of inhibitory control (IC), we used the visual go/no-go task (22), a computer-based task that assesses the examinee's ability to withhold a prepotent response. The examinee is presented with two different stimuli (i.e., go and no-go stimuli) one at a time. In this version, pictures of Donald Duck and Uncle Scrooge are used as stimuli. The task is divided into two blocks, with Donald being used as the go stimulus and Scrooge as the no-go stimulus in the other block and vice versa. There are 45 go conditions and 15 no-go conditions in each block (120 trials in total, 75% of which are go conditions and 25% are no-go conditions). The stimulus was presented for 500 ms with varying inter-stimulus intervals of 500 ms, 750 ms, and 1000 ms. The two blocks, as well as trials with different conditions, were run in a random and counterbalanced order. The examinees were instructed to respond by clicking on the mouse button promptly when the go stimulus appears on the computer screen and withhold their response when the no-go stimulus appears. The rate of responses to a no-go stimulus, referred to as commission errors (CEs), and the rate missing a go stimulus, called omission errors (OEs), were registered, in addition to reaction times (RTs) and multiple responses. The rate of CEs (excluding the so-called anticipatory responses where the RT was less than 250 ms) was used as a measure of IC. See also *Figure 3*.

4.2.6 Sociodemographic and health-related background information

In Study I, parents were asked to complete a questionnaire regarding child and family characteristics. Questions about the child included the child's age and gender, whether the child has any problems with health, whether the child needs any support in daycare or school, and whether the child has problems sleeping. Questions related to family characteristics included the family structure, number and ages of siblings, as well as the parents' employment, marital status, and education level.

In Study IV, we defined socioeconomic status based on the question, 'When including all the income in your household, how easy is it to cover the expenses?' Responses were given on a Likert scale, with 1 = very easy and 6 = very difficult. This information was collected at each time point, and SES was defined as the mean of responses at all three time-points. The correlation between SES ratings at any two time points was high ($r_s = .71$ to $.77$, $p < .001$).

100–91 *Superior functioning* in all areas (at home, at school and with peers); involved in a wide range of activities and has many interests (eg., has hobbies or participates in extracurricular activities or belongs to an organised group such as Scouts, etc); likeable, confident; 'everyday' worries never get out of hand; doing well in school; no symptoms.

90–81 *Good functioning in all areas*; secure in family, school, and with peers; there may be transient difficulties and 'everyday' worries that occasionally get out of hand (eg., mild anxiety associated with an important exam, occasional 'blowups' with siblings, parents or peers).

80–71 *No more than slight impairments in functioning* at home, at school, or with peers; some disturbance of behaviour or emotional distress may be present in response to life stresses (eg., parental separations, deaths, birth of a sib), but these are brief and interference with functioning is transient; such children are only minimally disturbing to others and are not considered deviant by those who know them.

70–61 *Some difficulty in a single area but generally functioning pretty well* (eg., sporadic or isolated antisocial acts, such as occasionally playing hooky or petty theft; consistent minor difficulties with school work; mood changes of brief duration; fears and anxieties which do not lead to gross avoidance behaviour; self-doubts); has some meaningful interpersonal relationships; most people who do not know the child well would not consider him/her deviant but those who do know him/her well might express concern.

60–51 *Variable functioning with sporadic difficulties or symptoms in several but not all social areas*; disturbance would be apparent to those who encounter the child in a dysfunctional setting or time but not to those who see the child in other settings.

50–41 *Moderate degree of interference in functioning in most social areas or severe impairment of functioning in one area*, such as might result from, for example, suicidal preoccupations and ruminations, school refusal and other forms of anxiety, obsessive rituals, major conversion symptoms, frequent anxiety attacks, poor to inappropriate social skills, frequent episodes of aggressive or other antisocial behaviour with some preservation of meaningful social relationships.

40–31 *Major impairment of functioning in several areas and unable to function in one of these areas* (ie., disturbed at home, at school, with peers, or in society at large, eg., persistent aggression without clear instigation; markedly withdrawn and isolated behaviour due to either mood or thought disturbance, suicidal attempts with clear lethal intent; such children are likely to require special schooling and/or hospitalisation or withdrawal from school (but this is not a sufficient criterion for inclusion in this category).

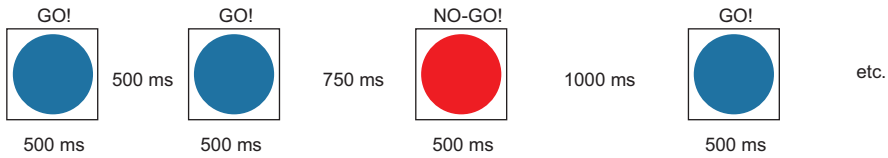
30–21 *Unable to function in almost all areas* eg., stays at home, in ward, or in bed all day without taking part in social activities or severe impairment in reality testing or serious impairment in communication (eg., sometimes incoherent or inappropriate).

20–11 *Needs considerable supervision* to prevent hurting others or self (eg., frequently violent, repeated suicide attempts) or to maintain personal hygiene or gross impairment in all forms of communication, eg., severe abnormalities in verbal and gestural communication, marked social aloofness, stupor, etc.

10–1 *Needs constant supervision* (24-hour care) due to severely aggressive or self-destructive behaviour or gross impairment in reality testing, communication, cognition, affect or personal hygiene.

Figure 2. The Children's Global Assessment Scale (235)

BLOCK 1



BLOCK 2

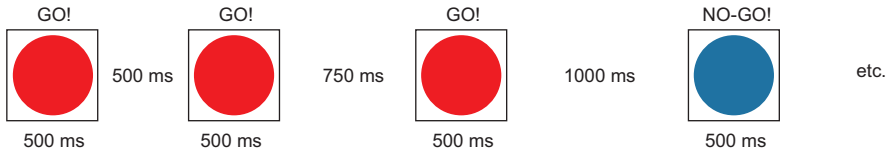


Figure 3. An illustration of the go/no-go task

4.3 STATISTICAL ANALYSES

Regarding the sociodemographic and health related background information in Study I, we formed a variable, ‘biological parents living with child’, with the categories ‘both’ (82.5%), ‘only mother’ (16.0%), and ‘only father’ (1.3%) based on the family structure and marital status information. We defined SES according to the parent with the highest employment status but excluded children whose parents were retired or students due to their small numbers; the degree of correlation between the mothers’ and fathers’ jobs was $r_s = .40$ ($n = 1,639$, $p < .001$, 2-tailed). We did not include parents’ educational level as a covariate because it was correlated with parents’ jobs (mothers: $r_s = .43$, $n = 1,663$, $p < .001$, 2-tailed; fathers: $r_s = .50$, $n = 1,675$, $p < .001$, 2-tailed). We also did not include needing special support because it was correlated with the child having an illness or disability ($r_s = .31$, $n = 1,696$, $p < .001$, 2-tailed).

In Studies I–III, we tested associations related to SDQ scores in univariate and multivariate ordinal or binomial logistic regression models after controlling for age and gender. When comparing groups, we used either the Chi-squared test, or if the Chi-squared test was not applicable because there were too few cases in the cross-tabulation cells, the Fischer’s exact test (for categorical variables), the independent samples T-test (for normally distributed continuous variables), or the Mann-Whitney U-test (for non-normally distributed continuous variables). We used the kappa statistic to assess the level of agreement between parents and children on mood. When examining correlations, we used Spearman’s Rho when the variables were ordinal or non-normally distributed and Pearson correlations when the variables were normally dis-

tributed continuous variables. In Study IV, we examined the cross-lagged associations between SDQ internalising scores and commission error rates using a random intercepts cross-lagged panel model (RI-CLPM). Analyses were carried out using IBM SPSS versions 22 and 24 in Studies I–III and IBM SPSS versions 24 and Mplus version 7 in Study IV.

4.4 ETHICS

All studies were conducted in accordance with local ethical standards. Studies I–III were approved by the Helsinki University Hospital Ethics Committee for gynaecology and obstetrics, paediatrics, and psychiatry. The participants in Study I gave informed consent. In Studies II–III, we used retrospective hospital register data. No informed consent from the participants was needed, but permission to use of the register data was obtained from the Hospital District of Helsinki and Uusimaa.

Study IV was approved by the Ethics Committee of the National Institute for Health and Welfare in Helsinki (27.9.2012, 504/2012; 12.3.2013, 547/2013). The children were informed of the study in advance via their parents, as well as at school, prior to participating. The children had the option to decline participation. Written informed consent was obtained from the parents.

5 RESULTS

5.1 EMOTIONAL PROBLEMS AND DEPRESSED MOOD IN A POPULATION-BASED SAMPLE (STUDY I)

5.1.1 Frequency of emotional problems and depressed mood

The proportions of children with normal, borderline and abnormal scores in the problem scales of the parent-rated SDQ are presented in *Figure 4*. In our sample, 5.8% of the children had an abnormal emotional problems score, and 5.7% had a borderline score.

In our study, we defined having depressed mood as the SDQ item ‘often unhappy, downhearted or tearful’ being rated somewhat or certainly true. According to this definition, depressed mood was reported in 16.0% of the children, with 1.2% of all parents endorsing the option ‘certainly true’. *Figure 5* presents the frequencies of different emotional symptoms.

5.1.2 Factors associated with emotional problems and depressed mood

The results of the univariate and multivariate ordinal regression examining the associations between child and family characteristics and emotional symptoms or depressed mood are presented in *Table 7*. The factors that were associated with emotional problems generally, were very similar to factors associating with specifically depressed mood. Both emotional problems and depressed mood were more common with increasing age. In addition, living

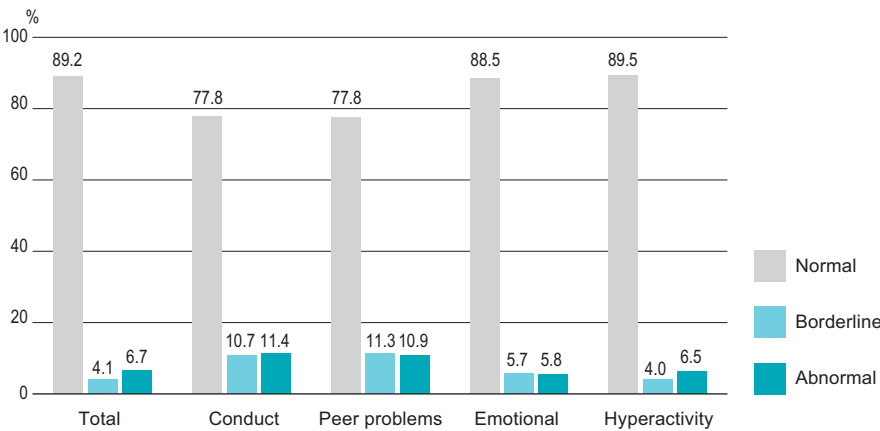


Figure 4. Frequencies of children scoring in the normal, borderline, or clinical range on the parent-rated SDQ in a population-based sample of 4–12-year-old children (n = 1,714)

with only one parent, the child having an illness or disability, and the child presenting with sleep problems were associated with emotional problems and depressed mood in a univariate analysis. There were no significant gender differences regarding emotional problems scores or depressed mood, and SES was not significantly associated with emotional problems or depressed mood.

In a multivariate ordinal regression analysis that included all the aforementioned statistically significant associates, all the associations remained statistically significant, except for the association between age and depressed mood. In the multivariate analysis, sleep problems had the strongest association with emotional problems (OR 4.31, 95% CI: 3.07–6.06, $p < .001$) and were one of the strongest associations with depressed mood (OR 2.70, 95% CI: 1.96–3.72, $p < .001$). The odds ratio for the child living with only his or her biological father was similar, but the finding was not as statistically significant (OR 3.00, 95% CI: 1.23–7.29, $p = .016$).

5.1.3 Co-occurrence of emotional problems, conduct problems, and hyperactivity

The results of the regression analysis examining the associations of emotional problems with conduct problems and hyperactivity are presented in *Table 8*. We found a significant association between emotional problems and conduct problems in our sample of 4–12-year-old children in a community-based sample. In the ordinal regression analysis, controlling for age, gender and SES, switching from normal emotional problems scores to borderline scores tripled the odds for having an abnormal conduct problems score (OR 3.25, 95% CI: 2.10–5.04, $p < .001$). Children with an abnormal emotional problems score had almost eight-fold

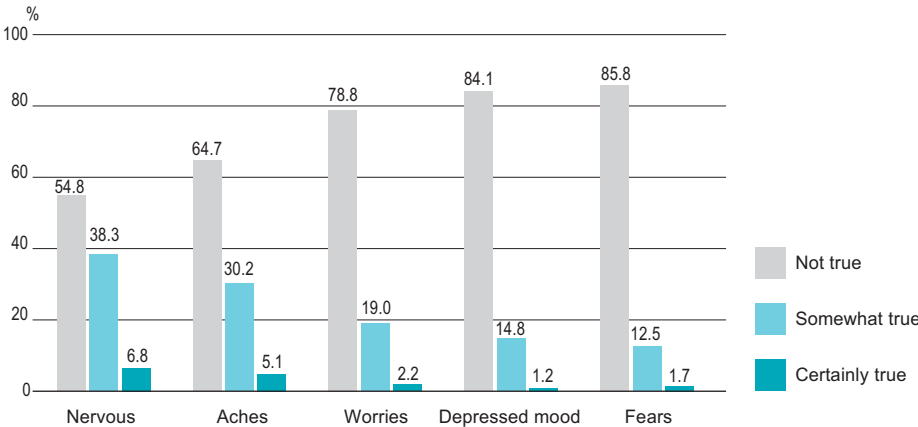


Figure 5. Frequencies of children scoring not true, somewhat true, or certainly true on the parent-rated SDQ in a population-based sample of 4–12-year-old children ($n = 1,714$)

Table 7. Relationships between child and family characteristics, emotional problems scores, and depressed mood

	Emotional problems score		Multivariate OR (95% CI)	Depressed mood	
	Univariate OR (95% CI)			Univariate OR (95% CI)	Multivariate OR (95% CI)
Age in years	1.11 (1.04–1.19)*		1.08 (1.01–1.15)*	1.09 (1.03–1.15)**	1.06 (1.00–1.12)
Gender: girl	1.12 (0.83–1.50)		1.28 (0.94–1.76)	0.98 (0.75–1.26)	1.04 (0.79–1.36)
Illness or disability	3.56 (2.56–4.94)***		2.84 (2.00–4.02)***	2.66 (1.96–3.62)***	2.21 (1.61–3.05)***
Sleeping problems	5.19 (3.75–7.19)***		4.31 (3.07–6.06)***	3.18 (2.34–4.33)***	2.70 (1.96–3.72)***
Biological parents living with child					
Both	0	0	0	0	0
only Mother	2.61 (1.86–3.67)***		1.99 (1.37–2.89)***	2.26 (1.66–3.07)***	1.88 (1.36–2.60)***
only Father	2.86 (1.11–7.34)*		2.77 (1.01–7.65)*	2.98 (1.27–7.00)**	3.00 (1.23–7.29)*
Has siblings	0.71 (0.48–1.03)		0.84 (0.55–1.26)	0.81 (0.57–1.14)	–
SES					
Manager	0	–	–	0	–
Managerial employee	0.75 (0.42–1.33)	–	–	0.96 (0.56–1.65)	–
White collar worker	0.82 (0.46–1.46)	–	–	1.19 (0.69–2.03)	–
Entrepreneur	0.67 (0.32–1.37)	–	–	1.20 (0.64–2.22)	–
Blue collar worker	1.27 (0.72–2.22)	–	–	1.53 (0.90–2.61)	–

OR = odds ratio; CI = confidence interval; * $p < .05$, ** $p < .01$, *** $p < .001$.

Regression analysis examining emotional problems and depressed mood as outcome variables and child and family characteristics as predictor variables. Emotional problems scores were categorised as normal, borderline, or abnormal (0–3, 4, 5–10, respectively), and the mood item was dichotomised as 'not true' or 'somewhat/certainly true'.

odds for having an abnormal conduct problems score, compared to children with no emotional problems (OR 7.86, 95% CI: 5.20–11.88, $p < .001$).

We found that each emotional symptom was associated with conduct problems when examined via univariate analysis, after controlling for age, gender, and SES. In a multivariate analysis that controlled for concurrent emotional symptoms, the association between depressed mood and conduct problems was the strongest. When all the other child and family characteristics found to be associated with emotional problems (i.e. illness/disability and sleep problems in the child, and not living with both parents) were included in the analysis, depressed mood, somatic complaints, and worrying remained significantly associated with conduct problems (ORs 1.51–3.19), with the strongest association between depressed mood and conduct problems (OR 3.19, 95% CI: 2.26–4.49, $p < .001$).

We also found a significant association between emotional problems and hyperactivity. In the ordinal regression analysis that controlled for age, gender, and SES, moving from a normal emotional problems score to borderline emotional problems score almost tripled the odds of having an abnormal hyperactivity score (OR 2.90, 95% CI: 1.66–5.01, $p < .001$). Moving from a normal emotional problems score to abnormal score increased the odds by nearly eight-fold (OR 7.73, 95% CI: 4.86–12.28, $p < .001$).

All the emotional symptoms were associated with hyperactivity when examined individually, after controlling for age, gender and SES. In a multivariate analysis that controlled for each emotional symptom subscore, depressed mood was the most strongly associated with hyperactivity, and the only symptom that remained significantly associated with hyperactivity when also controlling for other child and family characteristics related to emotional problems (OR 2.50, 95% CI: 1.60–3.91).

Next, we examined the frequency of conduct problems and hyperactivity among children with depressed mood, as well as the frequency of depressed mood among children with conduct problems or hyperactivity. Of the children with depressed mood, 38.7% had comorbid conduct problems or hyperactivity, compared to 9.7% of the children with normal mood. Of the children with hyperactivity and/or conduct problems, 32.6–52.9% presented with depressed mood. In the whole sample, 36 children (2.1%) had depressed mood concurrent with comorbid conduct problems and hyperactivity. See *Figures 6a* and *6b* for more information on the proportions.

Table 8. Association between emotional symptoms and conduct problems or hyperactivity in a Finnish population-based sample (n = 1,714).

	Conduct problems score		Hyperactive score	
	Univariate OR (95% CI)	Multivariate OR (95% CI)	Univariate OR (95% CI)	Multivariate OR (95% CI)
Mood	5.64 (4.26–7.45)***	3.33 (2.38–4.67)***	4.42 (3.13–6.24)***	2.78 (1.80–4.28)***
Aches	2.36 (1.85–3.03)***	1.61 (1.23–2.10)***	2.01 (1.45–2.79)***	1.33 (0.93–1.90)
Worries	3.86 (2.95–5.05)***	1.70 (1.22–2.37)**	3.03 (2.15–4.27)***	1.32 (0.85–2.05)
Nervous	1.43 (1.13–1.81)**	1.05 (0.81–1.36)	1.54 (1.12–2.12)**	1.10 (0.78–1.55)
Fears	3.06 (2.29–4.10)***	1.43 (1.01–2.02)*	3.42 (2.38–4.90)***	1.88 (1.23–2.88)*

OR = odds ratio; CI = confidence interval; * $p < .05$, ** $p < .01$, *** $p < .001$. Regression analysis examining problem scores as response variables and the emotional symptoms as predictor variables. The problem scores were categorised as normal, borderline, or abnormal (0–2, 3, and 4–10 for conduct problems and 0–5, 6, and 7–10 for hyperactive problems, respectively) and the emotional symptoms dichotomised as ‘not true’ or ‘somewhat/certainly true’.

Table 9. Association between emotional symptoms and conduct problems or hyperactivity in a Finnish child psychiatric sample (n = 862).

	Conduct problems score		Hyperactive score	
	Univariate OR (95% CI)	Multivariate OR (95% CI)	Univariate OR (95% CI)	Multivariate OR (95% CI)
Mood	2.03 (1.55–2.66)***	1.93 (1.39–2.66)***	0.98 (0.74–1.30)	0.97 (0.70–1.36)
Aches	1.38 (1.05–1.80)*	1.10 (0.83–1.48)	1.10 (0.83–1.45)	1.13 (0.83–1.53)
Worries	1.50 (1.14–1.98)**	1.12 (0.79–1.59)	0.98 (0.74–1.30)	0.99 (0.69–1.42)
Nervous	1.21 (0.92–1.58)	1.04 (0.78–1.39)	1.11 (0.84–1.49)	1.16 (0.86–1.58)
Fears	1.19 (0.91–1.54)	0.85 (0.62–1.16)	0.88 (0.67–1.16)	0.82 (0.60–1.14)

OR = odds ratio; CI = confidence interval; * $p < .05$, ** $p < .01$, *** $p < .001$. Regression analysis examining problem scores as response variables and the emotional symptoms as predictor variables. The problem scores were categorised as normal, borderline, or abnormal (0–2, 3, and 4–10 for conduct problems and 0–5, 6, and 7–10 for hyperactive problems, respectively) and the emotional symptoms dichotomised as ‘not true’ or ‘somewhat/certainly true’.

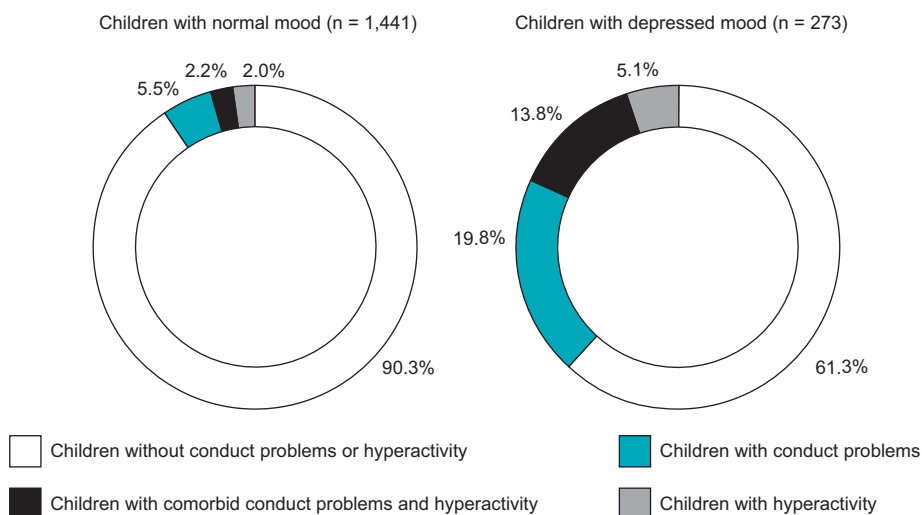


Figure 6a. Frequency of conduct problems and hyperactivity in children with normal and depressed mood

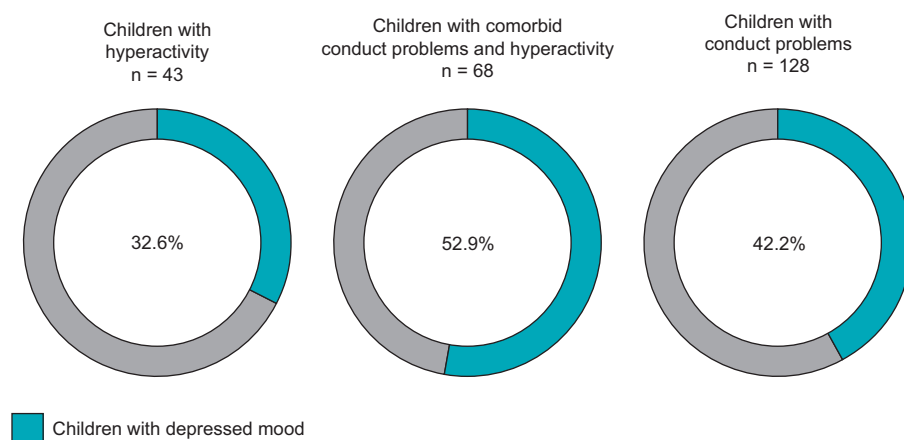


Figure 6b. Frequency of depressed mood in children with conduct problems and hyperactivity

5.2 EMOTIONAL PROBLEMS AND DEPRESSED MOOD IN CHILD PSYCHIATRIC PATIENTS (STUDY II)

5.2.1 Frequency of emotional problems and depressed mood

In the clinical sample, 42.8% of the children had an abnormal emotional problems score, and 13.1% had a borderline score. The frequencies of children scoring in the normal, borderline, and clinical ranges on the parent-rated SDQ are presented in *Figure 7*.

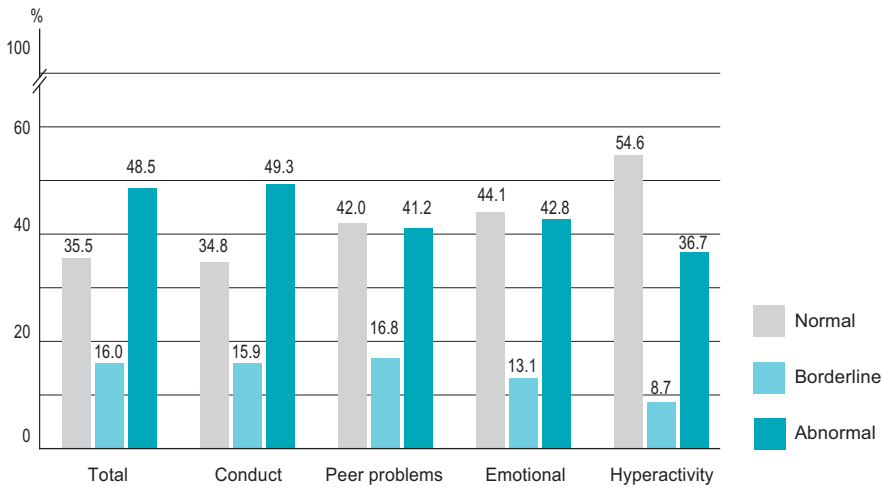


Figure 7. Frequencies of children scoring in the normal, borderline, and clinical ranges on the parent-rated SDQ in a clinical sample of 6–12-year-old children (n = 862)

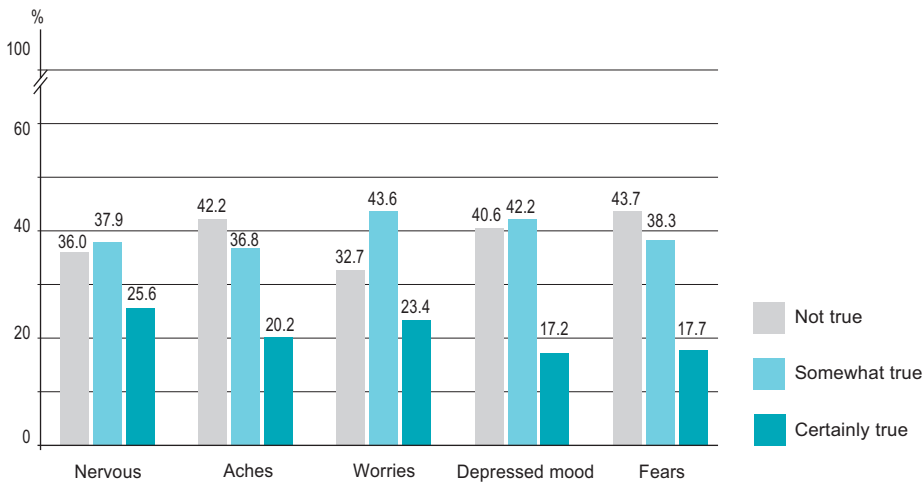


Figure 8. Frequencies of children scoring not true, somewhat true or certainly true on the emotional symptoms of the parent-rated SDQ in a clinical sample of 6–12-year old children (n = 862)

The prevalence of parent-rated depressed mood among the patients was 59.4%. Depressed mood was more common among girls than boys (68.1% vs. 54.5%, $\chi^2(1) = 15.263$, $p < .001$). Among children with a diagnosis of depression at admission, 81.8% had depressed mood, with parents of 48.5% of the depressed children endorsing the option 'somewhat true' and 33.3% the option 'certainly true' on the SDQ mood item. Depressed mood was common even

among patients without a clinical depression diagnosis, as over half of the children (56.5%) without a depression diagnosis had depressed mood according to their parents. The prevalence of different emotional symptoms in the whole sample is presented in *Figure 8*, and the prevalence of depressed mood among children with the diagnoses of depression, ODD/CD, and ADHD are presented in *Figure 9*.

5.2.2 Co-occurrence of emotional problems, conduct problems and hyperactivity

There was a weak positive correlation between emotional and conduct problems scores on the parent-rated SDQ ($r = .124, p < .001$, controlling for age and gender). When examining the associations between individual emotional symptoms and conduct problems in a univariate regression analysis that controlled for age and gender, we found positive associations with depressed mood, worrying, and somatic complaints (see *Table 9*). After including all the significant associates in the multivariate analysis, the association between depressed mood and conduct problems remained. However, we found no association between emotional problems and hyperactivity ($r = .052, p = .129$, see also *Table 9*).

Next, we examined the frequency of conduct problems and hyperactivity among children with depressed mood and the frequency of depressed mood among children with conduct problems or hyperactivity. As much as 88.1% of the children with depressed mood had comorbid conduct problems or hyperactivity, compared to 54.6% of the children with normal mood. Of the children with either hyperactivity or conduct problems, 38.5%–70.1% presented with depressed mood. Altogether, 17.6% of the whole sample had depressed mood concurrent with comorbid conduct problems and hyperactivity. See *Figures 10a* and *10b* for more information on the proportions.

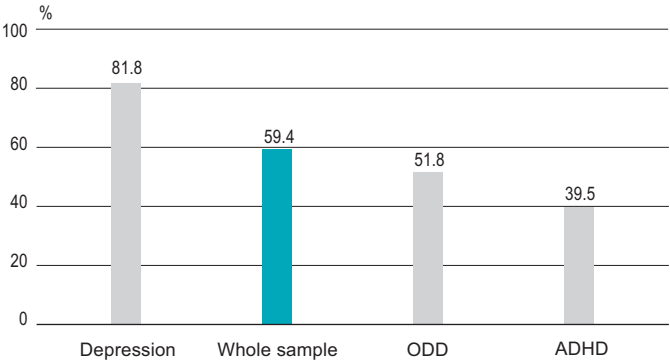


Figure 9. Frequencies of children with depressed mood in a clinical sample of 6–12-year-old children ($n = 862$)

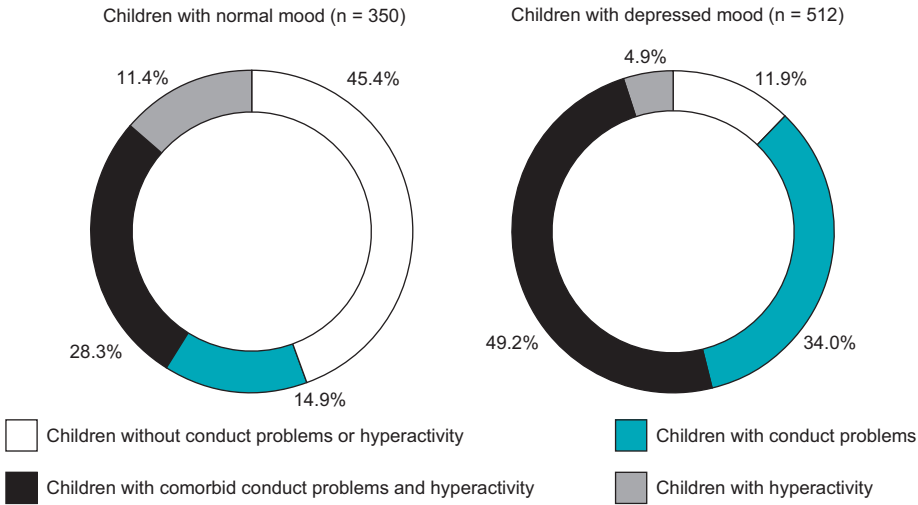


Figure 10a. Frequency of conduct problems and hyperactivity in children with normal and depressed mood

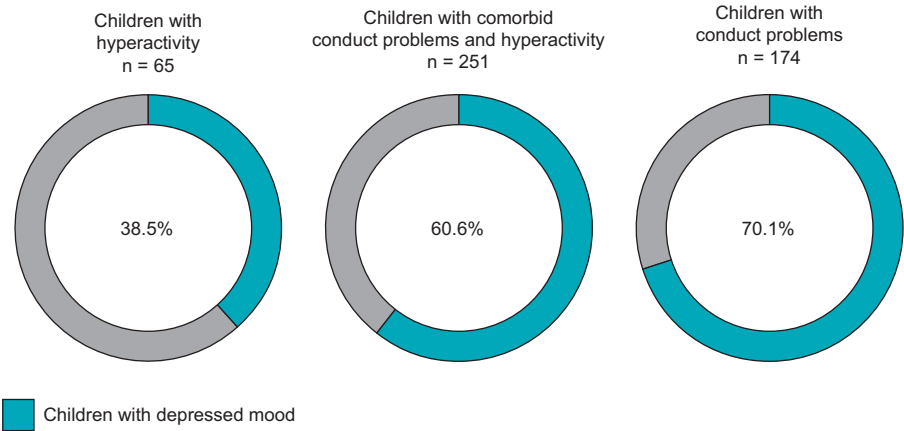


Figure 10b. Frequency of depressed mood in children with conduct problems and hyperactivity

5.2.3 Parent and child agreement in reporting depressed mood

To examine the agreement between parent and child reports of depressed mood, we determined the prevalence of child reports of depressed mood in the subsample of children who had responded to the 17D mood question ($n = 428$). The prevalence of self-reported depressed mood was 48.8%, while the prevalence of parent-rated depressed mood in this subsample was 62.1%. According to self-reports, 59.1% of the girls and 42.8% of the boys had depressed mood, and these gender differences were statistically significant ($\chi^2(1) = 10.716, p = .001$). Approximately 66% of the children and parents agreed on reports of depressed mood, with a Cohen's kappa of .336 (95% CI 0.250–0.422, $p < .001$). See also *Figure 11*.

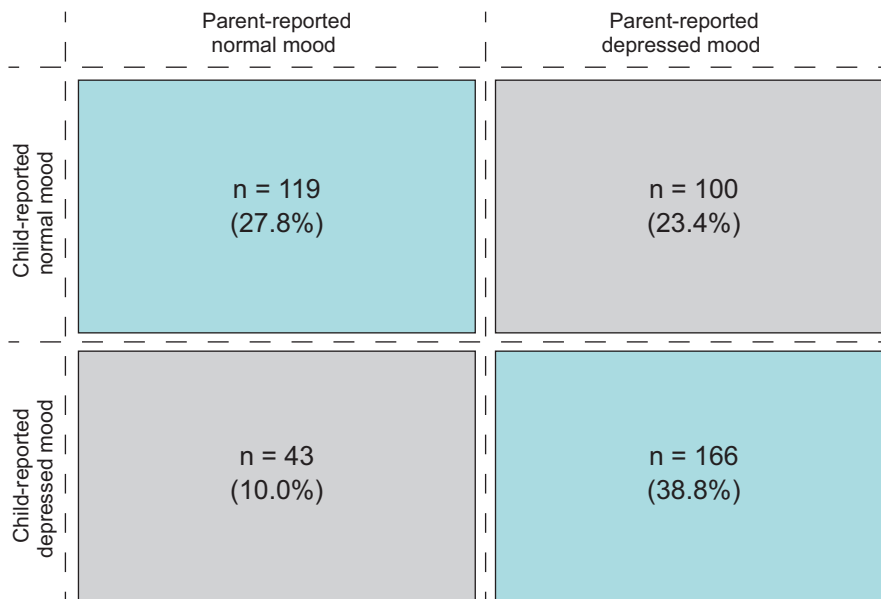


Figure 11. Agreement (green) and disagreement (gray) of parent and child reports of the child's mood in a child psychiatric sample (n = 428)

5.2.4 Depressed mood and impairment

We found that abnormal emotional problems scores, depressed mood as well as a clinician-based depression diagnosis were all associated with more impairment, as measured by the Children's Global Assessment Scale (CGAS). Depressed mood was associated with lower CGAS regardless of the source (i.e., parents or the child) of the report, and the association remained even when clinically depressed children were excluded from the analysis. See *Table 10* for comparisons.

5.3 EMOTIONAL SYMPTOMS AND SLEEP PROBLEMS IN A SAMPLE OF CHILD PSYCHIATRIC PATIENTS (STUDY III)

In the third study, we examined the prevalence of self-reported sleep problems and their associated symptoms in a child psychiatric sample (n = 431 children) and, within the sample, among the main diagnostic groups (i.e., ODD/CD, ADHD, anxiety disorder, and depressive disorder, see *Figure 12*).

The prevalence of self-reported sleep problems in the sample was 21.3%. Sleep problems were the most prevalent among children with a diagnosed de-

pressive disorder. Depressive disorders were the only diagnostic group statistically significantly associated with having a sleep problem ($\chi^2(1) = 6.038, p = .014$).

Among the whole patient sample, self-reported sleep problems were associated with more total difficulties and emotional problems in the parent-reported SDQ ($M = 17.8$ vs. $M = 16.0, p < .05$ and $M = 5.1$ vs. $M = 4.0, p < .001$, respectively). These associations remained significant after controlling for age and gender (OR 1.05, 95% CI: 1.02–1.09, $p = .005$ and OR 1.16, 95% CI: 1.06–1.27, $p = .002$ respectively, indicating an increase in the odds of sleep problems by a factor of 1.05 for each unit increase in total problems score and by a factor of 1.16 for each unit increase in emotional problems score).

Regarding the children with depressive disorders, reporting sleep problems was more common among girls (52.2% vs. 20.7%, $\chi^2(1) = 5.618, p = .018$), and the children reporting sleep problems were slightly older than those who did not. Reporting sleep problems was associated with a higher SDQ total problem score ($M = 19.5$ vs. $M = 15.4, p = .050$), even after controlling for age and gender (OR 1.11, 95% CI: 1.01–1.22 $p = .031$, indicating an increase in the odds of sleep problems by a factor of 1.11 for each unit increase in total problems score).

Among the children with anxiety disorders, there were no significant differences regarding age, gender, or SDQ scores between the patients with or without sleep problems. However, among the children with ODD/CD, reporting sleep problems was associated with higher emotional problems scores ($M = 4.7$ vs. $M = 3.3, p = .032$) but not with other subscales. The association with

Table 10. Comparisons of CGAS between children with normal and depressed mood

Patient group	CGAS Mean (SD)
Children with parent-reported depressed mood (whole sample)	52.21 (7.73)
Children with parent-reported normal mood (whole sample)	54.62 (8.47)***
Children with parent-reported depressed mood (those with F32 excluded)	52.82 (7.72)
Children with parent-reported normal mood (those with F32 excluded)	54.85 (8.42)**
Children with self-reported depressed mood	52.36 (7.21)
Children with self-reported normal mood	55.82 (8.49)***
Children with abnormal emotional problems score	52.20 (7.73)
Children with normal or borderline emotional problems score	53.93 (8.83)**
Children with a depression diagnosis	49.25 (7.25)
Children with other diagnoses	53.71 (8.10)***

CGAS, Children's Global Assessment Scale; SD, standard deviation;

* $p < .05$, ** $p < .01$, *** $p < .001$, from T-test

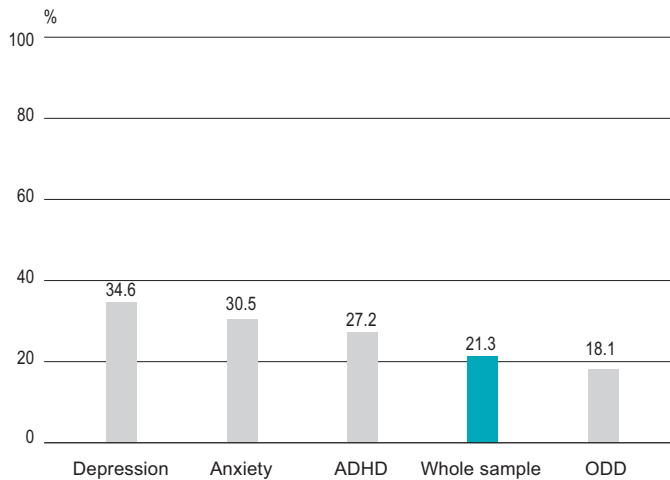


Figure 12. The prevalence of self-reported sleep problems in a child psychiatric sample (n = 431)

emotional problems and sleep problems remained significant after controlling for age and gender (OR 1.36, 95% CI: 1.08–1.71, $p = .010$ indicating an increase in the odds of sleep problems by a factor of 1.36 for each unit increase in emotional problems score).

Among the children with ADHD, reporting sleep problems was associated with higher emotional problems scores ($M = 4.1$ vs. $M = 2.6$, $p = .006$), as well as with higher total difficulties scores $M = 22.4$ vs. $M = 18.1$, $p = .006$) and conduct problems scores $M = 5.9$ vs. $M = 4.4$, $p = .034$) When the association between sleep problems and emotional/conduct problems was examined in a regression model to determine the role of the different symptoms as explanatory variables controlling for age and gender, only emotional problems remained significantly associated with sleep problems (OR 1.36, 95% CI: 1.04–1.89, $p = .040$ indicating an increase in the odds of sleep problems by a factor of 1.36 for each unit increase in emotional problems score).

5.4 INTERNALISING SYMPTOMS AND INHIBITORY CONTROL IN A POPULATION-BASED SAMPLE (STUDY IV)

5.4.1 Results of preliminary analyses

According to tests of invariance assumptions, we could constrain the autocorrelations to be the same over time for inhibitory control (IC) ($\chi^2(6) = 3.92$, $p = .687$), but not for internalising symptoms ($\chi^2(6) = 32.03$, $p < .001$). The cross-

Table 11. Descriptive statistics and correlations between study variables

Variable	M	SD	2	3	4	5	6	7	8	9	10	11	12
Demographics													
1. Gender			-.01	-.04*	-.01	.11**	.01	-.01	.09**	.03	-.01	.02	.02
2. Grade	1.89	0.77	—	.01	.93**	-.08**	.02	.93**	-.07**	.04	.92**	-.08**	.05*
3. SES	2.93	1.02	—		.03	.03	.18**	.03*	.05**	.18**	.03	.01	.18**
T1													
4. Age	8.18	0.83	—	—	—	-.09	.04	1.00**	-.10**	.05*	1.00**	-.10**	.06**
5. CR	0.41	0.17	—	—	—	—	-.03	-.09**	.44**	-.01	-.09**	.38**	-.00
6. INT	1.45	1.21	—	—	—	—	—	.04	-.02	.66**	.04	.01	.60**
T2													
7. Age	8.72	0.83	—	—	—	—	—	—	-.09**	.05*	1.00**	-.10**	.06**
8. CR	0.44	0.18	—	—	—	—	—	—	—	-.00	-.09**	.44**	-.00
9. INT	1.41	1.23	—	—	—	—	—	—	—	—	.05*	.01	.68**
T3													
10. Age	9.71	0.83	—	—	—	—	—	—	—	—	—	-.10**	.06**
11. CR	0.41	0.19	—	—	—	—	—	—	—	—	—	—	.02
12. INT	1.48	1.34	—	—	—	—	—	—	—	—	—	—	—

Correlations have been corrected for classroom level clustering.

SES = socioeconomic status; INT = score on the SDQ Internalising subscale (theoretical range 0–20); CR = commission rate (i.e., the proportion of commission errors in the go/no-go task, with a range of 0–1)

* $p < .05$; ** $p < .001$

lagged effects could not be assumed to be the same between T1–T2 and T2–T3 ($\chi^2(12) = 33.90, p < .001$). Furthermore, the autocorrelations and cross-sectional correlations did not depend on a child's gender or grade level ($\chi^2(35) = 28.01, p = .793$). The effects of SES on internalising symptoms and IC were similar, irrespective of the child's gender or grade-level ($\chi^2(30) = 25.31, p = .710$), with lower SES predicting elevated internalising symptoms from T1–T3 ($B = 0.18\text{--}0.21, p < .001$), and poorer IC from T1–T3 ($B = 0.01\text{--}0.02, p < .030$). Also, the effects of the child's age in years and months on internalising symptoms and IC were also similar, irrespective of the child's gender or grade level ($\chi^2(30) = 22.53, p = .834$), with higher age predicting more severe internalising symptoms at T1 ($B = 0.15, p = .043$) and better IC at T2 ($B = -0.04, p < .001$) and T3 ($B = -0.04, p < .001$). The combined model had an excellent fit ($\chi^2(196) = 194.59, p = .515$, CFI = .999, TLI = .999, RMSEA = 0.01, 95% CI [0.00, 0.02], SRMR = 0.03).

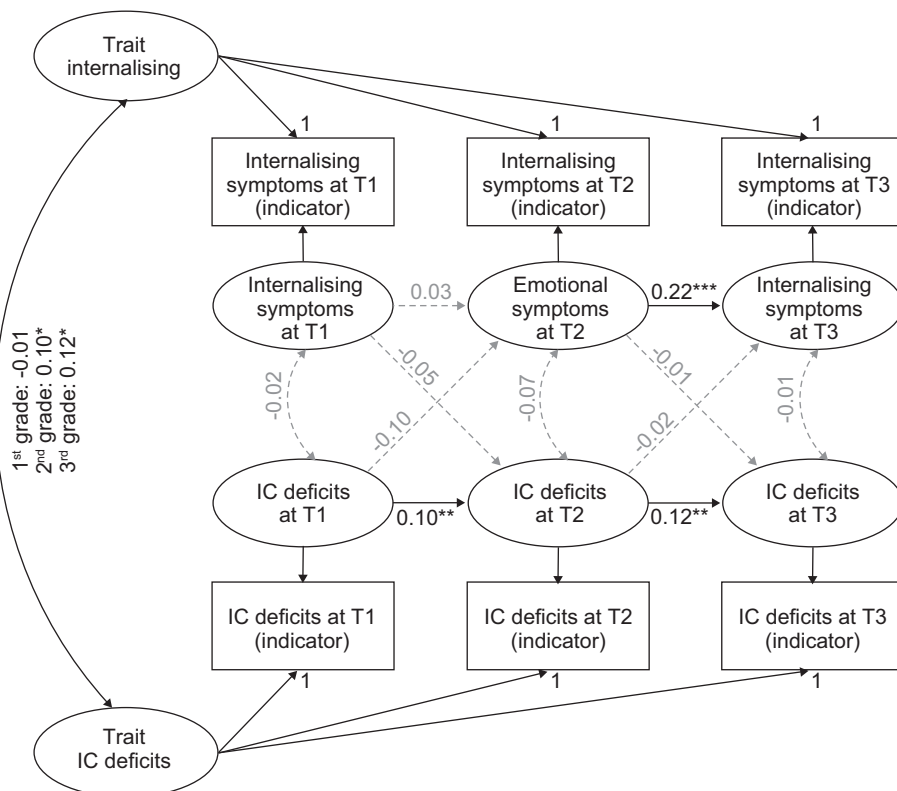


Figure 13. Associations of inhibitory control and internalising symptoms among a population-based sample ($n = 2,784$)

5.4.2 Internalising symptoms and inhibitory control

Regarding the cross-lagged effects between internalising symptoms and IC, we first tested whether a child's gender or age moderated the cross-lagged effects of internalising symptoms on IC ($\Delta\chi^2(10) = 6.70, p = .753$) or the cross-lagged effects of IC on emotional symptoms ($\Delta\chi^2(10) = 14.44, p = .154$). As no moderating effects were found, we were able to test the hypotheses about cross-lagged effects across all six gender and age subgroups. We found no cross-lagged effects between internalising symptoms and IC in either direction, which means changes in internalising symptoms did not predict later changes in IC ($\Delta\chi^2(2) = 0.66, p = .720$), and vice versa ($\Delta\chi^2(2) = 0.24, p = .885$). Regarding the trait level effects, we found that the child's grade level moderated the association between trait-level internalising symptoms and IC ($\Delta\chi^2(4) = 13.58, p = .009$). Trait-level internalising symptoms were associated with trait-level IC deficits among second-grade children ($B_{\text{std}} = 0.10, B = 0.01, SE = .01, p = .041$) and third-grade children ($B_{\text{std}} = 0.11, B = 0.02, SE = 0.01, p = .032$) but not first-grade children ($B_{\text{std}} = -0.04, B = -0.01, SE = 0.01, p = .418$). However, gender did not moderate the association between trait-level internalising symptoms and IC ($\Delta\chi^2(3) = 3.91, p = .271$). These results are presented in *Figure 13*.

6 DISCUSSION

6.1. FREQUENCY OF EMOTIONAL PROBLEMS AND DEPRESSED MOOD (STUDIES I–II)

6.1.1 Population-based sample

In Study I, we examined the prevalence of emotional problems in a population-based nationally representative sample of 4–12-year-old children. Based on exceeding the cut-off score for abnormal emotional problems according to the norms of the original UK sample (253), we found that 5.8% of the children had emotional problems according to their parents. This rate is low compared to other studies that used the same cut-off scores and parent-reports. Previously, rates from 7.4–13.93% have been reported in European samples of 5–7 year-olds to 6–18 year-olds (36,49,74,76), and rates as high as 21.2% in Egypt (259) and 37.3% in Pakistan (260) have also been reported. Our finding is in line with previous observations in a sample of Finnish 4–9-year-old children, as well as other studies conducted in Nordic countries that have suggested using cut-off points lower than the UK's norms to distinguish children scoring above the 90th percentile (63,73,261). It should be kept in mind that differences in rates across cultures do not necessarily represent differences in the prevalence of problems; instead, they may reflect cultural differences in experiencing, describing, and reporting symptoms (69,262).

Second, we found that 16.0% of Finnish children had depressed mood. This was defined as the SDQ item 'often seems unhappy, downhearted, or tearful' being rated as 'somewhat true' (14.8%) or 'certainly true' (1.2%). This finding is in line with a study in a sample of 8–10-year-old Danish children in which 16.4% of the children had depressed mood based on an internet-based diagnostic assessment, DAWBA, albeit in a sample where children with sub-threshold or major depression were excluded (29). Taking this into account, the prevalence in the present study is likely somewhat lower than it would have been among Danish children if depressed children had been included. In a previous Finnish study, 9.3% of a 8–9-year-old birth cohort were reported being miserable or tearful (57). The somewhat higher rate of depressed mood in our study could result from a low response rate, which might have caused overrepresentation of children with depressed mood, if parents who are worried of their children have been more prone to return the questionnaire. On the other hand, there are 20 years between the data collection of the two studies, which could explain the differences. However, other Finnish studies have not detected a true rise in the incidence or the prevalence of depression in this age group (263,264) leaving methodological differences the most likely explanation for the difference. Then, depressed mood was detected in 9.5%

of a 14–18-year-old adolescent sample based on a diagnostic interview (11). It would be expected that the prevalence of depressed mood would be higher among adolescents than among preadolescent children. It is likely that in a diagnostic interview, the threshold for rating a symptom as being present is higher, which might be considered to enhance the reliability of the report. For comparison, the proportion of children with the ‘certainly true’ rating of depressed mood (1.2%) is of the same magnitude as the prevalence estimate of major depression MDD (50).

We found only one previous study providing endorsement rates of single items on the SDQ-P (60). In a Swedish study of 6–10-year-olds, the prevalence of depressed mood was 9.0%, somewhat lower than in our study. However, parents have repeatedly been found to report fewer emotional symptoms than their offspring (18,67,68) as they may not be aware of them, and available self-reports yield clearly higher rates. Among a Norwegian sample, 39% and 25% of 10–13-year-old girls and boys, respectively, reported depressed mood (61), while this was true for 34% and 11% of the girls and boys, respectively, in a sample of Swedish 14–15-year-olds (63) and for 32% of the 13–17-year-old adolescents in a Finnish study (62). These differences could reflect an increased incidence of depression in adolescence (4), as well as the importance of youth self-reports when screening for depressive symptoms (58,265).

6.1.2 Clinical sample

In Study II, we examined the prevalence of emotional problems and depressed mood in a sample of 5–12-year-old child psychiatric outpatients. We found that nearly 43% of the children had emotional problems. The only previous study we found that reported the prevalence of abnormal SDQ scores among child psychiatric patients found that 36% of the 4–16-year-old patient sample had emotional problems according to the SDQ-P (266).

We found that almost 60% of the patients had depressed mood according to the parents. Depressed mood was most common among children with depression (in 82% of the children). Few studies have published self-reported rates of depressed mood in child or adolescent psychiatric patients other than those with depression (267). A study conducted by Bennet and colleagues investigated the prevalence of individual depression symptoms among adolescent patients with depressive disorders, as well as a group of psychiatric but non-depressed controls. They reported depressed mood in nearly 100% of the patients with major or minor depression and in only 4.1% and 2.9% of the clinical control group boys and girls, respectively, in a clearly smaller group of patients than in our study. This large discrepancy could be due to the difference in defining depressed mood and the diagnostic assessment. In the study conducted by Bennet and colleagues, the presence of depressed mood, as well as the diagnosis, were evaluated according to a

semi-structured interview performed by a clinician. This would be expected to enhance the accuracy of the diagnosis compared to an initial diagnosis set without structured or semi-structured interviews. In our study, some children with a depressive disorder may have been diagnosed with another disorder in the initial phase. Furthermore, during the interview, the clinician determines the threshold for rating depressed mood as present, which might result in a higher threshold than a self-report. Parent ratings might include more ‘false positives’ than clinician interviews. However, it has been found that only 44% of children with an emotional disorder based on DAWBA results were rated as having a probable emotional disorder according to the SDQ-P (268), suggesting that SDQ-P reports produce underestimates of the prevalence of emotional problems rather than overestimates.

Moreover, the shift from childhood to adolescence could also explain the differences between these two samples. Major depressive disorder is still rare in childhood compared to other emotional problems and disorders in childhood, as well as to rates of depression in adolescence. In childhood, psychiatric syndromes are not as differentiated as later in adolescence. Mixed symptoms that do not fit the diagnostic categories are common, possibly resulting in depressed mood being less specific for major depression in childhood than in adolescence. Differences in the rates of depressed mood among depressed patients (98.2–100% in the Bennet et al. study and 81.8% in our study) could also reflect these same issues regarding the definition of depressed mood and different manifestations of symptoms in samples of different ages. In summary, our results suggest that emotional problems and depressed mood are common in both community populations of children, as well as among child psychiatric patients.

6.2 CO-OCCURRENCE OF EMOTIONAL PROBLEMS, CONDUCT PROBLEMS, AND HYPERACTIVITY (STUDIES I–II)

Next, we examined the associations of emotional problems and depressed mood with conduct problems and hyperactivity in a population-based (Study I) and in a clinical sample (Study II). In the population-based sample, we found that emotional problems were significantly associated with both conduct problems and hyperactivity. In the multivariate analysis of the associations between individual emotional symptoms and conduct problems or hyperactivity, the association was strongest for depressed mood. With respect to the frequency of co-occurring problems, we found that approximately 50% of the children with conduct problems or hyperactivity also had depressed mood.

In the clinical sample, we also found an association between emotional problems and conduct problems, and again, depressed mood was the strongest individual associate with conduct problems. However, the correlation between emotional problems and conduct problems was weak in the clinical sample, and there was no correlation between emotional problems and hyperactivity. Despite the small or non-existent correlation between these symptom dimensions, there was considerable co-occurrence of depressed mood among children with ODD/CD or ADHD. While 70% of the children with conduct problems and 50% of the children with an ODD/CD diagnosis had depressed mood, this was true for about 40% of the children with hyperactivity or an ADHD diagnosis.

Our results suggest a robust association exists between depressed mood and disruptive behaviour problems and disorders. We are not aware of previous studies of depressed mood among children with ODD/CD. In previous studies, depression was reported in 0–46% of children with ODD/CD in population-based samples (134,269) and 24–50% in clinical samples (146,269). Subthreshold depression has been reported in only 3.4% of adolescents with conduct disorder (39). Another study found that ODD/CD was more common among children with subthreshold depression (9.1%) than among children who did not have any depression (0.9%) (29). Regarding comorbid anxiety disorders among children with ODD/CD, comorbidity rates of 5.8–55.3% among population-based samples (134,269) and 38.0–50.0% in clinical samples (269) have been reported. Up to 69.2% of children with ODD/CD have been found to have a comorbid anxiety disorder (134).

Regarding the association of emotional problems and depressed mood with hyperactivity or ADHD, the findings are not as clear because of the null finding in the patient sample, which is in line with some of the previous studies (270,271). However, in the patient sample, the rate of co-occurrence of emotional and hyperactive problems is substantial, which is relevant from a clinical viewpoint even if there is not a specific association between the two. We are not aware of previous studies that examined depressed mood among clinical samples of children with ADHD. However, among a community-based sample of 6–8-year-old children, where 2% of the children with ADHD had a comorbid MDD and 8% had a comorbid SD (compared to 0.5% and 1% of the controls, respectively), 32% of the children were reported to experience sadness and 52% with irritability (150), which is in line with the present study. In clinical samples, comorbidity rates of 12% regarding dysthymia and 21.6% regarding minor depression/dysthymia have been found (272,273). Furthermore, the reported prevalence of abnormal emotional problems scores (approximately 38%) among a clinical sample of ADHD is comparable to our findings (274). According to another study using SDQ in a clinical ADHD sample, 69% of the children with a borderline/abnormal emotional problems score on the SDQ

had a comorbid emotional diagnosis, and having an abnormal emotional problems score predicted the most common anxiety disorder diagnoses but not depressive disorders (273). Comorbid anxiety disorders have been reported in 0–25% of children with ADHD in population-based studies (134) and in approximately 25% of the children based on population-based and clinical studies (275), while rates as high as 52.7% for comorbid social phobia in a clinical sample have been found (273).

Altogether, our results may represent the other side of the coin of the previous findings that have suggested that irritable mood symptoms (compared to oppositional or vengeful symptoms) in ODD predict later depression and anxiety (276). More generally, irritable mood predicts future emotional disorders more accurately than disruptive behaviour (12), and irritable mood is a link between emotional and disruptive disorders in the case of indirect comorbidity (277). Irritable and depressed mood are both associated with dysfunction in dopaminergic mesolimbic circuits, which are also associated with impulsive behaviour, thus being a possible link between disrupted mood and externalising symptoms (278). We also found co-occurring depressed mood, conduct problems, and hyperactivity symptoms among 2.1% of the children in the population, and in the clinical sample, 18% of the children presented with all three. A previous study found that 11% of children with ADHD had a comorbid ODD and minor depression or dysthymia, and over 80% of these children had irritable mood (272). The authors stated that these co-occurrent symptoms could account for the overdiagnosis of bipolar disorder. A new diagnostic entity, disruptive mood dysregulation disorder (DMDD) was introduced in the DSM-5 and will be included in the ICD-11 to identify children with chronic irritability and severe temper outbursts. It is likely that at least some of the children with the aforementioned co-occurrent symptoms would meet the criteria for DMDD. Further research is warranted to examine the prevalence of DMDD in Finland.

Our results suggest that depressed mood is of particular importance in the co-occurrence of emotional problems with conduct problems and, possibly, with hyperactivity. We also found that depressed mood is a common symptom among child psychiatric patients. In clinical practice, a careful assessment of all symptoms, including subthreshold ones, is recommended. Co-occurring depressed mood and disruptive behaviour may indicate a shared background for depressed mood and conduct problems, or an increased risk for depressed mood among children with disruptive behaviour or vice versa. Recognising depressive symptoms among children with behavioural disorders could help prevent secondary comorbid disorders (279–281).

6.3 FACTORS ASSOCIATED WITH EMOTIONAL PROBLEMS AND DEPRESSED MOOD (STUDIES I–III)

6.3.1 Overview of the associated factors

Next, in Study I, we investigated child and family characteristics and their association with emotional problems and depressed mood. We found that the child's older age, the presence of illness or disability of the child, as well as the child having sleep problems, were associated with emotional problems and depressed mood. Regarding family characteristics, not living with both biological parents was associated with emotional problems and depressed mood. Of these associated factors, the child having a sleep problem stood out as the most important one in the multivariate analysis.

The associations that we found are mostly in line with previous studies examining risk factors for emotional symptoms or disorders. The small positive association between age and emotional problems or depressed mood reflects an increase in emotional problems with age. Previous studies have typically reported that the prevalence of emotional problems and depression is quite stable in middle childhood, but these problems increase upon entering adolescence (4,6,44). Gender was not associated with emotional problems or depressed mood. This was an expected finding, as gender differences are typically not found in child samples (36,48,49,54). Rather, gender differences in the prevalence of emotional symptoms typically emerge only in adolescence (4,6,44). The association between the child's illness or disability and emotional problems and depressed mood supports previous findings of the associations between somatic illness and emotional problems and depression (127,268,282). In line with previous studies (53,117,283), we also found that not living with both biological parents was associated with emotional problems and depressed mood.

However, we did not find an association between family socioeconomic status and emotional problems or depressed mood in our study. Previously, lower SES has been frequently associated with poorer mental health among youth (36,55,66,117,247). A study comparing the impact of SES on emotional symptoms in adolescents across the Nordic countries found that a high prevalence of emotional symptoms was associated with low socioeconomic status in all the countries (66). However, in Finland, the role of socioeconomic differences was among the smallest, and the differences were mainly seen among boys. It is possible that the definition of SES in our study (i.e., parental employment status) was not sensitive enough to detect socioeconomic differences in the sample.

Our study adds to the previous literature by examining factors associated with depressed mood. It was expected that the associations between child and family factors, emotional problems, and depressed mood would be similar in our study since the depressed mood item was included in the emotional problems subscale. It is, therefore, worth noting that the factors associated with depressed

mood reported for the first time in this study are similar to those that have been reported to be associated with emotional problems or depression previously.

6.3.2 Emotional symptoms and sleep problems

In Study I, sleep problems stood out as the strongest associate of emotional problems and depressed mood among community children. Sleep problems have been cross-sectionally and longitudinally associated with childhood emotional problems and depressed mood in previous studies, and the relationship has been suggested to be reciprocal (93,97,180–182,184). Sleep problems have been shown to predict later depressive symptoms (93,97,180–182) and vice versa (97,184), with sleep problems having a greater effect on depression (183,284).

Only a few studies have examined the association between sleep and mood in particular, and these provide somewhat discrepant findings regarding the reciprocal effects of sleep and daily mood (177,285,286). In their study, Kourou and El-Sheikh (285) detected a significant between-person association between sleep latency and children's mood but no within-person associations between sleep and children's mood the next day. However, they found a significant within-person association in the opposite direction (i.e., having a worse mood than usual predicted higher activity during sleep and longer sleep latency the subsequent night). They also found that child-reported negative mood mediated the association between lower sleep efficiency or longer sleep latency and parent-reported internalising and externalising symptoms. In turn, Könen and colleagues (286) found that among 8–11-year-old children, high sleep quality was related to low negative affect the following morning and noon, explaining 10% of the variance in the morning but only 3% at noon. Time in bed was not related to affect at all, and negative affect did not have an impact on subsequent sleep. Instead, positive affect predicted higher sleep quality. The different findings could be explained by the use of different methods. In the first study, sleep was measured by actigraphy, whereas in the latter study, it was based on a subjective report of sleep. Another study found that among 14–17-year-old adolescents, sleep restriction worsened mood and the ability to regulate negative emotions (177). While the present study does not provide new information regarding the possible causal relationship between depressed mood and sleep, it is among the few to examine their association in children. Our results suggest that the association between sleep problems and depressed mood is robust in children.

In Study III, we examined the relationship between emotional symptoms and child-reported sleep problems in a sample of child psychiatric patients. Overall, 21% of the children in the clinical sample reported having a sleep problem. Previously, 18% of Finnish children in a community sample reported a sleep problem (155). However, we did not find any previous studies on child self-reports of sleep problems in general psychiatric samples. Among adolescents in specialty mental health services, 31.3% reported sleep problems (158).

The difference between these results could reflect an increase in sleep problems in adolescence compared to middle childhood (287) or, possibly, the enhanced recognition of them. Interestingly, only 2.8% of the sample in the present study had been diagnosed with a sleep disturbance, which is in line with a previous study also based on the medical records of pediatric primary care patients, where a sleep disorder diagnosis was found in 3.7% of the sample (288). Studies based on interviews of community samples suggest that sleep disorders are more prevalent (289,290). These results suggest that some of the sleep disorders possibly go undetected or undiagnosed in clinical practice.

In examining the association between sleep problems and clinician-based diagnoses, we found that self-reported sleep problems were the most common in groups with mood or anxiety emotional disorder diagnoses. In the depression group, 34.6% of the children reported a sleep problem. In studies based on parent reports, rates ranging from 65%–91% have been presented (29,30,178). Regarding anxiety disorders, 30.5% of the children in our sample reported a sleep problem, which is somewhat lower than in a previous study among 7–14-year-olds, where 54% reported a sleep problem (190). Again, in studies with parent reports on sleep, the prevalence of sleep problems was even higher, with rates ranging from 42%–88% (189,291,292). Few previous studies have compared parent- and self-reported rates of sleep problems in childhood clinical samples, but among adolescents with anxiety, parents reported more sleep problems than did the adolescents (190), suggesting that our results may also reflect differences in parents and children in reporting sleep problems, but other methodological reasons cannot be ruled out.

Next, we examined the association between dimensionally measured symptoms and sleep problems. We found that sleep problems were associated with emotional symptoms in the whole sample, as well as among children with ODD/CD or ADHD. The association between ODD/CD and sleep has been rarely examined. In previous studies, ODD was independently associated with sleep problems when adjusted for comorbid emotional disorders in a population-based sample, but the role of subthreshold emotional symptoms was not examined (168). No association between objective measures of sleep and emotional symptoms were found in a patient sample with disruptive behaviour disorders (206), but this study did not examine the role of subjective sleep problems. Thus, the present study provides tentative results suggesting that self-reported sleep problems among children with ODD/CD may be indicative of comorbid subthreshold emotional symptoms. Sleep problems have been examined much more often among children with ADHD, but child self-reports of sleep are not frequent. However, our finding supports the previous results that suggest sleep problems in children with ADHD are at least partly explained by internalising comorbidities (195,197–199,205). As for studies that suggested sleep problems among children with ADHD are not explained by comorbid

emotional disorders, the role of comorbid subthreshold emotional symptoms was taken into account (293–295). While the evidence is mixed, ADHD seems to be associated with a risk of depression (144,151,271) and calls for identifying early markers of this risk have been issued (271). As we found sleep problems to be associated with emotional symptoms among children with ADHD, and subthreshold emotional symptoms also predict future emotional disorders (8,82), child-reported sleep problems may indicate an elevated risk of developing depression, making children with ADHD and sleep problems a potential target of preventive efforts.

However, among children with depression or anxiety, we found no association between sleep problems and the severity of emotional symptoms. This differs from the findings of previous studies, where sleep problems were found to be associated with levels of depressive symptoms among children with depression (178), as well as among children with anxiety (296). It is possible that there were too few children in the depression and anxiety groups to detect the associations.

6.3.3 Parent and child agreement in reporting depressed mood in patients

We used Cohen's kappa to evaluate agreement on depressed mood between parents and children in the sample and found a fair level of agreement $K = .34$ (297). Our finding is in line with previous studies regarding depressive symptoms. Angold and colleagues found moderate agreement ($K = .40$) among 7–25-year-old youth, who reported more depressive symptoms than their parents (16). Other studies have mostly found weak to moderate correlations (.03–.45) between parent and child ratings of depressive symptoms or internalising symptoms more generally (67,298–301). Among 9–15-year-old youth, parent-youth agreement did not vary as a function of age (301).

We found that parents reported depressed mood in 79% of children who reported depressed mood, indicating that at this age, parents recognise depressed mood in their children quite well. Our finding supports the role of parents as potential informants regarding depressed mood in child psychiatric patients.

6.3.4 Depressed mood and impairment in patients

We made a consistent finding that based on clinician ratings, children with depressed mood were more impaired than children with normal mood. This finding held even when we performed a comparison excluding the children with a depression diagnosis. We are unaware of other studies that have specifically examined the association between depressed mood and impairment. However, our findings are consistent with previous ones regarding subthreshold depression. Subthreshold depression has been concurrently associated with impairment in community samples of 9-year-old children (8) and 11–17-year-old

adolescents (302), as well as in a referred sample of 6–17-year-olds (303). Sub-threshold depression has also been associated with later impairment (8,82). It was previously suggested that it is necessary to assess comorbid subthreshold conditions when conducting clinical assessments (39). Our findings of the significance of comorbid depressed mood support this view.

6.4 INHIBITION AND INTERNALISING SYMPTOMS IN SCHOOL-AGED CHILDREN (STUDY IV)

In the final part of the study, we examined the relationship between internalising symptoms and inhibitory control. First, we tested the hypothesis that inhibitory control deficits are an underlying risk factor of internalising problems (i.e., whether within-level person changes in inhibitory control performance predict subsequent changes in internalising symptoms). Second, we tested the hypothesis that inhibitory control deficits emerge as a complication of internalising symptoms (i.e., whether within-level person changes in internalising symptoms predict subsequent changes in inhibitory control). Neither of these hypotheses was confirmed. Finally, we tested the trait hypothesis (i.e., whether internalising problems and inhibitory control performance are associated at the between-person level). This hypothesis was confirmed. We also found that this association was moderated by the child's age, as the association was significant only in the oldest age groups. Taken together, these results do not provide support for hypothesised causal relationships between inhibitory control skills and internalising symptoms in this age-group; instead, we suggest that the association is due to another mechanism.

While poor inhibitory control skills have been repeatedly found to predict later internalising symptoms (24,224,225,304–306), no previous studies of children examined the reciprocity of these associations while distinguishing between within-person and between-person levels. According to the critique, when longitudinal associations are examined with statistical models that fail to take into account trait-like qualities and variety in the developmental trajectories of the examined constructs, the results may be misleading in terms of causal conclusions (307).

Our results suggest that inhibitory control and internalising symptoms are associated at the trait level. Specifically, what we found is that children who performed poorer than children on average on IC tasks had more internalising symptoms than the average child. A change in a child's IC performance or internalising symptoms did not predict a subsequent change in the other. Our result is in line with a previous twin study that examined cross-lagged associations between executive functions and depressive symptoms among adolescents (227). It did not find cross-lagged associations between the com-

mon EF and depressive symptoms. Instead, they found the two to be concurrently associated. Moreover, their results suggest that the association between a common EF base, with which IC is considered isomorphic, at least among adolescents and adults (208), and depressive symptoms is due to a shared genetic background (227). In addition to genetics, some other shared correlates could explain the association. For example, IC and internalising symptoms are both related to other aspects of EF (208,308), which could account for the association.

We found that the association between IC and internalising symptoms was moderated by age. The trait-level association was found among the two oldest age groups (i.e., among 8–9-year-old children) at T1 of our study. The association between internalising symptoms and IC could, perhaps, emerge when the demands for IC skills increase due to growing social and academic challenges. Furthermore, the association between IC skills and internalising symptoms could become detectable only when emotional symptoms begin to be more common. However, age has previously been found to moderate the association between IC and internalising symptoms such that the two are associated in children aged 8–10 but not among those aged 11–12, which contradicts the above explanation (22). An association between common EF and internalising symptoms has also been found among older adolescents (227).

In the present study, gender had no effect on the examined associations between IC and internalising symptoms. Previously, gender was sometimes found to moderate the associations (224,309). It has been remarked that findings regarding the associates of internalising symptoms and disorders may be spuriously accentuated in females because internalising symptoms are less frequent among males, and thus, there might not be enough power in the studies to show associations among males (310). Our large sample size may have aided in overcoming this issue and explain why we did not find gender to moderate the association in our study. However, a study of an even larger community sample also found gender to moderate the association between IC and symptoms in the anxious-misery domain (309). As our study was conducted among 7–9-year-old children and theirs among 8–21-year-olds, the different age ranges of the samples may explain the conflicting finding regarding gender effects.

Taken together, our results suggest that children with IC deficits could be at an increased risk for internalising symptoms, but these deficits are not causally related to emerging internalising symptoms. Rather, IC deficits could be a marker of increased vulnerability for internalising symptoms and psychopathology in general. While our results can only be interpreted in relation to IC skills, the detected association could reflect an association between the common EF factor and internalising symptoms rather than IC deficits specifically. As this study was conducted in a population-based sample within an age group where actual internalising disorders are relatively rare and internalising symptoms quite sta-

ble, it may be that there were not enough internalising problems or changes in the symptoms for us to detect cross-lagged associations.

Our results do not support a causal role of IC deficits in internalising symptoms in this age group, but the results may not be generalisable to other ages. Furthermore, our results can only be interpreted with regards to a neutral cognitive task. One line of research suggests that children at risk for internalising symptoms may be more easily distracted by negative emotional stimuli, resulting in poorer performance in emotional adaptations on IC tasks (311–314). Finally, regarding EFs in the pathogenesis of internalising disorders, deficits in shifting and disengaging attention warrant future research (28).

6.5 METHODOLOGICAL CONSIDERATIONS

Certain limitations must be considered when interpreting the results of the present study. The study was based on data collected from large population-based samples of children and as a routine procedure of clinical assessment, limiting the methods used in the present study. First, we used parent reports of the SDQ as a measure of mental health across studies. While the SDQ's psychometric properties are acceptable, its brevity may result in compromised validity in clinical populations (274). Despite its limitations, the SDQ has been found to be a useful tool in identifying mental health problems, and there is support for its use also in the clinical context (254). As a measure of depressed mood, we used a single SDQ item for parent reports and a single 17D dimension for child reports. The depressed mood item (item 103) in the CBCL has been shown to discriminate clinical from non-clinical children (32). While the validity or reliability of the individual items of the SDQ has not been assessed, single items on the 17D may be interpreted as separate dimensions; however, it is primarily a quality-of-life-questionnaire. The cut-off points between normal and deviant have not been established or validated. The questionnaires designed for measuring depressive symptoms almost always include only one or two items about depressed mood, and thus, there are not many validated measures for this purpose. An evaluation based on an interview by a clinician or a researcher would have provided the most reliable measure of depressed mood in terms of clinical definition. Furthermore, regarding the measurement of sleep problems, using a validated self-report questionnaire of child sleep problems instead of the sleep dimension of the 17D would have produced more detailed information about sleep problems, but they are not included in the routine procedures in our clinic and, hence, were unavailable.

Second, we had to rely on a single rater regarding the presence of psychiatric problems. The parents were the main source of information related to mental health. This was the most problematic in Studies I and II, where par-

ents were the main source of all the information. Relying on parent reports of emotional symptoms may result in underestimating the number of emotional problems, as parents often report fewer emotional problems than the children themselves (67,68). Furthermore, a parent's own depression or other worries could result in over-reporting of problems in the child (70,71) although it has also been suggested that the increased rates of reported problem behaviour could be due increased accuracy of the depressed mother rather than a bias (315). Including a screening to detect parental depression as well as including multiple informants would have allowed to take into account the different views of different reporters. However, the study included large samples of children. This sample size would not have been possible if the children had been interviewed and collecting information via questionnaires from such young children is not feasible.

Third, the low response rate in the Study I is a possible source of bias. We may have underestimated or been unable to detect associations that apply in the missing part of the sample. Then, the results may be emphasizing associations that apply in particular in the participating children. For example, families of low socioeconomic status may be underrepresented in this study (316).

Fourth, examining associations based on subscales of a single questionnaire is problematic since the detected associations may reflect properties of the SDQ rather than associations between problems. More robust evidence could have been provided had we used distinct and more specific measures of emotional and behavioural problems.

Fifth, the diagnoses used to compare children based on the presence of different disorders were obtained from a hospital register. The diagnoses were set by clinicians based on information collected during an initial assessment. According to research, clinician-based diagnoses generally have low correlations with diagnoses obtained from structured or semi-structured interviews (317). However, even if this limits the conclusions that can be made regarding strictly defined disorders, our study provides data from a naturalistic setting, and the results may, thus, be especially useful in helping to identify emotional problems among patients in the child psychiatry clinic of Helsinki University Hospital.

Sixth, although Study IV was designed to examine cross-lagged associations that possibly indicate causality, Studies I–III were cross-sectional. Hence, we are unable to make conclusions regarding the temporal, let alone causal, relationships between the examined variables.

Finally, in Study IV, we used a single assessment, the go/no-go task, to assess inhibitory control (IC). Performance on a single cognitive task is also affected by other factors than the variable of interest, such as other executive functions, possible distractors and individual strategies (318). Thus, conclusions must be made with the caution that the IC variable, to some extent, also includes variance explained by the aforementioned factors.

7 CONCLUSIONS

The present study made some interesting and valuable findings regarding emotional problems and depressed mood among Finnish children. First, we provide tentative results of the prevalence of depressed mood among Finnish children, keeping in mind the limitations of the measure. We found that one in six children in the population and almost four in six child psychiatric patients have depressed mood. Depressed mood was associated with conduct problems and hyperactivity more strongly than other emotional symptoms in the population-based sample and with conduct problems in the clinical sample, suggesting that there may be a common background or another link between depressed mood and disruptive behaviour. Our findings support the view that child mental health problems often present on a spectrum, with mixed symptoms tending to be the rule and limited, and well-defined disorders the exception. Furthermore, among child psychiatric patients, depressed mood was associated with increased impairment, supporting the dimensional view of depression among children and suggesting that even subclinical depressive comorbidities might need to be addressed in clinical practice.

Next, we found that sleep problems, not living with both parents, and the child having an illness or disability were associated with emotional problems and depressed mood. This is consistent with previous findings of the associates of emotional problems, suggesting that in identifying children with depressed mood, it is useful to pay attention to similar potential risk factors than regarding emotional problems in general. In addition to the association between sleep and emotional problems in the population-based sample, we found that among child psychiatric patients, children with affective disorders reported the most sleep problems. We also found that child-reported sleep problems were the most prevalent among children with emotional disorders and that among children with behaviour problems, sleep problems were especially associated with the severity of emotional symptoms. This suggests that when a child reports a sleep problem, it might be indicative of emotional problems and a more careful assessment of them is warranted.

Finally, we found an association between IC deficits and internalising problems. More specifically, we found that the two were associated at the trait level, and we did not find evidence of a causal relationship in this developmental stage. The results suggest that IC deficits and emotional problems might share a common cause, such as a shared genetic background, and that children with IC deficits might have an endogenous susceptibility for emotional problems.

Taken together, our study helps in identifying children with emotional problems and depressed mood to prevent future psychiatric problems, as well as identify the ones in need of treatment more effectively. Because transient

depressed mood is not easily distinguishable from depressed mood that possibly forecasts depression, we recommend that parents and adults who work with children should be aware of the early stages and risk factors for depression.

Despite the study's methodological limitations, some recommendations can be made. Emotional symptoms seldom are problematic in the child's environment and may go unnoticed until they are severe. However, it is important to pay attention to emotional symptoms, especially depressed mood and related factors, as these symptoms are rather common in the general population and very common in clinical settings. Emotional symptoms complicate the clinical presentation of child psychiatric patients with externalising disorders, and these symptoms need to be addressed when planning treatment. Children should be asked about their mood and sleep. Child-reported sleep problems should be considered a possible hint of emotional symptoms that deserve further attention. We recommend that the significance of even subclinical comorbidities should be assessed in all child psychiatric patients.

Future studies should further examine the current and future effects of depressed mood. Prospective cohort studies of the longitudinal outcomes of depressed mood are needed to make further observations on the trajectories of depression, beginning with early manifestations. Studies of primary and secondary intervention efforts to prevent depression among children with depressed mood are also needed to make recommendations regarding interventions for depressed mood.

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A handwritten signature in cursive script, appearing to read 'Katu'.

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